MULTIPLE-REGION EQUILIBRIUM WORLD TRADE MODEL: THE ORANGE INDUSTRY

By

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A multiple-region equilibrium trade model for the fresh orange industry including 11 regions of the world was developed and estimated. The model is used to understand the major driving factors effecting fresh orange consumption and trade. The model is a modified spatial equilibrium model that takes into account that products are differentiated by country of origin. Armington developed the demand theory underlying this assumption. The model assumes a constant ratio of elasticity of substitution (CRES) index which makes the model somewhat less restrictive.

The model is estimated using a nonlinear two stage least square procedure. Graphical, statistical and economic analyses of the results are used to evaluate the performance of the model and the implications for the fresh orange industry. The results indicate that the model performs well. A sensitivity analysis of the system is developed to evaluate the consequences of changes in the main variables of the model.

Total market demand analysis shows that market prices and income are the major drivers for world consumption of fresh oranges in most regions. Major world importers are more sensitive to changes in the average market price than major world consumers with domestic production. Export supply equations show weak FOB export price parameters versus strong fresh production parameters. This indicates that major export decisions are driven mainly by fresh production.

Product demand analysis shows the role of prices as an allocative tool and the importance of the market size to determine consumer preferences when facing several product sources. Market positions and opportunities for all regions were determined. The regions included the United States, Canada, South America, the Mediterranean-EEC countries, the rest of the EEC, the rest of western Europe, the Middle East and North Africa countries, the rest of Africa, the Far East, Oceania, and the Communist Bloc. The Communist Bloc was defined as it existed prior to the recent political changes of 1991.

CHAPTER 1
INTERNATIONAL TRADE AND AGRICULTURAL PRODUCTS. THE ORANGE INDUSTRY

Introduction

Developing countries have long recognized the importance of trade to their national welfare. Exchanging the goods that they produce with their endowments and experience for the goods in which other countries have a comparative advantage provides the potential for both growth and development. The world is becoming smaller in terms of communication and the ability to trade. International trade has been expanding at an increasing rate, especially in the last three decades. Most countries are dependent to some degree on the foreign currency generated through trade. Some countries consider international trade as one of the most important means for development, especially the ones that have a high foreign debt. The United States continues to implement important macro-economic and commercial policies to improve its competitive position in the international trade arena.

Less developed countries use international trade as a means for development and subsistence because their domestic economies are poor and small in most cases. Therefore, it is very important to develop new markets for their products as well as to develop new marketable products. Most of these nations possess a high foreign debt that must be paid with

foreign currency. Imports to these countries are frequently higher than exports, which implies a need for more foreign currency, i.e., they are often net importers.

In the 1980s, many less developed countries changed their development strategy from an import substitution scheme to export promotion. While the reasons for change differ among countries, the main reasons include interruption of multilateral and bilateral agreements, the increase of the fiscal deficit due to subsidies, recognition of inefficiencies due to high import barriers, and the need of foreign currency.

Developed countries such as Japan, Germany, Italy, and France are highly interdependent on international trade. The United States also recognizes the importance of being competitive and the need of interdependence with potential trade partners. These changes increased the importance of international trade and market development worldwide with the consequence being an increase in the relative importance of international trade.

In theory, international trade is dependent on comparative advantage. This means that countries will tend to trade goods and services that they produce efficiently for goods and services in which other countries have a comparative advantage. Porter (1990) mentions four broad attributes to shape the environment in which local firms compete in order to achieve international success in a particular industry. First, factor conditions, which mean the nation's position in factors of production necessary to compete in a given industry; second, demand conditions which consider the nature of domestic demand for the

industry's product or service; third, related and supporting industries which refer to the presence or absence in the nation of supplier and related industries that are internationally competitive; fourth, firm strategy, structure, and rivalry which refer to the conditions of the nation governing how companies are created, organized, and managed, and the nature of rivalry. However, in the real world, international trade is not solely driven on comparative advantage but also on variables including tariffs, quotas, subsidies, international agreements, and domestic policies.

World real-value trade increased at an average rate of 6.7% a year while real Gross National Product (GNP) increased at an average rate of 4.1% from 1966 to 1986 (International Monetary Fund [IMF] Direction of Trade). During that period the United States economy became increasingly interdependent with world economies. The value of United States total trade as a percentage of GNP increased from 7.5 to 14 for the same period.

International Trade of Agricultural Products

International agricultural trade depends heavily on national and regional policies. For agricultural products, import protection and export subsidies are usual in most countries; especially in cases where a particular product is socially desirable and support groups are politically strong. For example, grain production is usually protected from imports in most countries. Reasons given to support such policies have to do with income distribution given the amount of people involved in production, process and distribution of grains; self-sufficiency; and less

need of foreign currency. In many cases, the government has to support production through higher prices for these people to continue in business. This implies higher fiscal deficits, given subsidies and underpriced exports to get rid of excess inventories. This promotes inefficiencies and a waste of resources.

A controversial agricultural policy is the Common Agricultural Policy (CAP) of the European Community (EC). The CAP is primarily a market-regulation and price-support policy. It currently covers grains, rice, poultry and eggs, dairy products, pork, beef and veal, sugar, certain fruits and vegetables, and certain processed agricultural products. The protectionism system includes common customs tariffs for imports and internal regulations designed to protect EC producers. The system gradually eliminates trade barriers among nations within the bloc but imposes a common external trade barrier. The variable levy system is the major instrument used by the EC to protect domestic markets from foreign competition. It imposes a levy equal to the difference between the world price and the domestic support price. This tends to make EC imports from other countries have a perfectly inelastic demand within a considerable price range, with outside countries the residual suppliers Some of the proceeds from the levy are further used to subsidize EC exports (Tweeten, 1979). The CAP regulations in fresh fruits set quality standards for a variety of products and outline a price and intervention system in most cases.

Tariffs and nontariff barriers, along with preferential treatment, have become increasingly important factors influencing agricultural trade. In the case of fresh fruits, CAP regulations are of particular importance

with the recent enlargement of the EC to 12 nations with the inclusion of Spain and Portugal. Both are major producers and exporters of fresh fruits to the rest of Europe.

Other factors affecting agricultural trade are income, population, demographic variables within the trading regions, and exchange rates. Income and population are important to determine the level of consumption. As these two variables increase, higher levels of consumption and shifts from one bundle of goods to another are expected. Exchange rates affect the real terms of trade among countries, especially in cases when they are managed by governments and are not allowed to fluctuate freely in the market. Transportation is an important linkage variable in world trade. The linkage is between the Free On Board (FOB) export price from any country and the Cost Insurance Freight (CIF) import price at the final market. Substitute product prices should have a positive effect on the consumption of a specific commodity.

Total agricultural trade increased at an annual rate of 2.8% while agricultural production increased by 2.3% a year from 1966 to 1986 (Food and Agricultural Organization [FAO] Trade and Production Yearbooks). The United States agricultural sector represents about 15% of total exports. Hence, United States agricultural market prices are strongly influenced by supply and demand conditions among major world markets (Statistical Abstract of the United States and FAO Trade Yearbook). These statistics reflect the increasing importance of trade in the world economy and, in particular, the importance of agriculture in world trade.

The focus of the present study will be the fresh orange industry. World trade in the fresh orange industry must be studied from the

perspective of two different goods, fresh and processed oranges. To improve our understanding and ease the following analysis of the fresh orange industry, Tables 1.1 to 1.15 show 11 regions of significant trade. These regions have been selected by considering similarities in supply or demand among the countries and their importance in the production of and international trade in fresh oranges. The regions identified are the United States, Canada, Latin America, Mediterranean-European Community countries, the rest of the European Community (EC), the rest of Western Europe, Middle East/North Africa countries, the rest of Africa, the Far East, Oceania and the Communist Bloc. The Communist Bloc is defined as it existed prior to the recent political changes of 1991. Cuba is included in the Bloc given the existence of trade agreements with Eastern Europe. Appendix A shows the composition of these regions.

As shown in Table 1.1, world orange production increased at a rate of 3.3% a year from 1966 to 1986. Table 1.2 shows that world fresh utilization increased at a rate of 2.6% a year for the same period. The processed industry increased faster than fresh utilization in the last decade. From 1978 to 1986, world processed production increased at a rate of 2.7% a year while fresh utilization increased 2.4% a year (see Tables 1.3 and 1.2).

Fresh orange world trade increased by 2.2% a year from 1966 to 1986, and 1.1% from 1978 to 1986 (see Tables 1.4 and 1.6). If intraregional trade or trade between countries of the same region is not considered, international trade in fresh oranges showed an increase of 1.9% a year for the same period (see Tables 1.8 and 1.12). This percentage is higher than 1.1%, meaning that trade among regions increased in the last decade.

Table 1.1 World Orange Production by Region

Region	1966	1976	1978	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86	Annual Growth Rate 1978-86
	----- (000) Metric Tons -----				--- Percent of Change ---		
United States	7598	10183	9268	7192	-0.3	-3.4	-3.1
Canada	0	0	0	0	N.A.	N.A.	N.A
Latin America	5540	12117	11832	18535	6.2	4.3	5.8
Mediterranean EC	4208	5472	5267	6840	2.5	2.3	3.3
E.C	4	31	29	34	11.3	0.9	2.0
Rest of Western Europe	0	00	0	0	N.A.	N.A	N.A
Middle East/North Africa	3067	4664	5364	5794	3.2	2.2	1.0
Rest of Africa	773	1034	1132	1022	1.4	-0.1	-1.3
Far East	4023	6532	6771	8354	3.7	2.5	2.7
Oceania	249	360	410	574	4.3	4.8	4.3
Communist Bloc	192	292	408	728	6.9	9.6	7.5
World Total	25654	40685	40481	49073	3.3	1.9	2.4

Source: FAO Production Yearbook. Various issues

Table 1.2 World Fresh Utilization by Region

Region	1966	1976	1978	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86	Annual Growth Rate 1978-86
	----- (000) Metric Tons -----				--- Percent of Change ---		
United States	2575	2294	2031	2322	-0.5	0.1	1.7
Canada	0	0	0	0	N.A.	N.A.	N.A.
Latin America	5290	8336	7342	9394	2.9	1.2	3.1
Mediterranean-EC	3689	4807	4600	5787	2.3	1.9	2.9
E.C.	4	31	29	34	11.3	0.9	2.0
Rest of Western Europe	0	0	0	0	N.A.	N.A	N.A.
Middle East/North Africa	2862	4273	4943	5122	3.0	1.8	0.4
Rest of Africa	692	894	980	919	1.4	0.3	-0.8
Far East	3801	5634	5934	7619	3.5	3.1	3.2
Oceania	202	196	202	251	1.1	2.5	2.7
Communist Bloc	192	287	398	638	6.2	8.3	6.1
World Total	19307	26752	26459	32086	2.6	1.8	2.4

Table 1.3 World Processed Production by Region

Region	1978	1986	Annual Growth Rate 1978-86
	(000) 65 Degree Brix Metric Tons		Percent of Change
United States	732.5	481.3	-5.1
Canada	0.0	0.0	N.A.
Latin America	406.7	895.3	10.4
Mediterranean-EC	60.4	103.2	6.9
E.C.	0.0	0.0	N.A.
Rest of Western Europe	0.0	0.0	N.A.
Middle East/North Africa	38.1	65.8	7.1
Rest of Africa	13.8	10.1	-3.8
Far East	75.8	72.0	-0.6
Oceania	18.8	31.6	6.7
Communist Bloc	0.9	8.8	32.9
World Total	1347.1	1668.0	2.7

Table 1.4 World Fresh Orange Exports by Region

Region	1966	1976	1978	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86	Annual Growth Rate 1978-86
	----- (000) Metric Tons -----				--- Percent of Change ---		
United States	258.6	464.1	355.9	413.0	2.4	-1.2	1.9
Canada	0.1	0.1	0	0.3	6.9	16.1	31.5
Latin America	106.6	119.2	164.7	229.3	3.9	6.8	4.2
Mediterranean-EC	1514.6	1937.5	1802.2	2833.9	3.2	3.9	5.8
E.C.	32.8	122.6	121.5	195.0	9.3	4.8	6.1
Rest of Western Europe	2.1	5.9	7.8	2.2	0.2	-9.5	-14.7
Middle East/North Africa	1215.9	1871.9	1893.2	1316.7	0.4	-3.5	-4.4
Rest of Africa	264.4	285.7	274.4	209.0	-1.2	-3.1	-3.3
Far East	65.8	142.3	137.5	113.9	2.8	-2.2	-2.3
Oceania	23.5	11.2	30.1	47.3	3.5	15.5	5.8
Communist Bloc	0.2	60.4	140.9	35.0	30.5	-5.3	-16.0
World Total	3484.5	5020.7	4928.3	5395.6	2.2	0.7	1.1

Source: United Nations Trade Data Tapes.

Table 1.5 World Processed Orange Exports by Region

Region	1978	1986	Annual Growth Rate 1978-86
	(000) 65 Degree Brix Metric Tons		Percent of Change
United States	148.1	76.4	-7.9
Canada	0.5	2.8	23.1
Latin America	296 1	831.4	13.8
Mediterranean-EC	29 1	33.5	1.8
E.C.	97 6	207.2	9 9
Rest of Western Europe	3.3	7.1	10.1
Middle East/North Africa	95.9	112.3	2.0
Rest of Africa	2.3	1.4	-5.6
Far East	0.9	6.7	29.0
Oceania	0.1	1.5	45.3
Communist Bloc	0	0.3	46 2
World Total	673 8	1280.7	8.4

Source. United Nations Trade Data Tapes.

Table 1.6 World Fresh Orange Imports by Region

Region	1966	1976	1978	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86	Annual Growth Rate 1978-86
	----- (000) Metric Tons -----				--- Percent of Change ---		
United States	28.3	32.6	52.9	49.4	2.8	4.2	-0.8
Canada	180.5	225.5	180.2	182.1	.0	-2.1	0.1
Latin America	9.7	18.1	14.2	3.8	-4.6	-14.5	-15.2
Mediterranean-EC	0.0	0.9	1.5	8.2	N.A	24.8	24.2
E.C.	2398.4	2736.2	2655.5	3464.6	1.9	2.4	3.4
Rest of Western Europe	384.6	439.7	436.0	551.2	1.8	2.3	3.0
Middle East/North Africa	22.0	590.4	440.5	279.0	13.5	-7.2	-5.5
Rest of Africa	10.6	10.6	14.5	8.2	-1.3	-2.5	-6.8
Far East	119.3	238.9	251.7	382.8	6.0	4.8	5.4
Oceania	15.3	8.9	15.5	20.4	1.4	8.7	3.5
Communist Bloc	315.6	718.8	865.8	445.8	1.7	-4.7	-8.0
World Total	3484.5	5020.7	4928.3	5395.6	2.2	0.7	1.1

Source. United Nations Trade Data Tapes

Table 1.7 World Processed Orange Imports by Region

Region	1978	1986	Annual Growth Rate 1978-86
	(000) 65 Degree Brix Metric Tons		Percent of Change
United States	136.8	500.6	17.6
Canada	98.3	89.5	-1.2
Latin America	6.6	7.1	0.9
Mediterranean-EC	4.0	16.7	19.6
E.C.	324.6	568.4	7.3
Rest of Western Europe	69.8	49.6	-4.2
Middle East/North Africa	14.1	10.0	-4.2
Rest of Africa	2.0	1.6	-2.4
Far East	11.7	29.4	12.3
Oceania	1.0	3.7	18.1
Communist Bloc	5.1	4.1	-2.7
World Total	673.8	1280.7	8.4

Source: United Nations Trade Data Tapes

Table 1.8 World Fresh Orange Export Quantities by Region (Excluding Intraregional Trade)

Region	1966	1976	1978	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86	Annual Growth Rate 1978-86
	----- (000) Metric Tons -----				--- Percent of Change ---		
United States	258.6	464.1	355.9	413.0	2.4	-1.2	1.9
Canada	0.1	0.1	.0	0.3	6.9	16.1	31.5
Latin America	103.4	103.1	152.7	226.9	4.0	8.2	5.1
Mediterranean-EC	1514.6	1937.3	1802.2	2833.7	3.2	3.9	5.8
E.C.	2.8	9.6	13.0	21.1	10.5	8.2	6.3
Rest of Western Europe	1.1	0.9	4.9	1.1	.0	2.6	-17.0
Middle East/North Africa	1205.3	1410.9	1524.9	1092.6	-0.5	-2.5	-4.1
Rest of Africa	262.7	280.2	268.6	206.9	-1.2	-3.0	-3.2
Far East	24.3	64.5	47.9	41.9	2.8	-4.2	-1.6
Oceania	13.7	8.7	21.2	36.7	5.1	15.5	7.1
Communist Bloc	0.2	2.0	4.2	12.4	23.9	19.8	14.6
World Total	3386.6	4281.3	4195.5	4886.6	1.9	1.3	1.9

Source: United Nations Trade Data Tapes.

Table 1.9 World Fresh Orange Export Values by Region (Excluding Intraregional Trade)

Region	1966	1976	1978	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86	Annual Growth Rate 1978-86
	----- In Million of U.S. Dollars -----				--- Percent of Change ---		
United States	47.0	118.8	144.0	233.0	8.3	7.0	6.2
Canada	.0	.0	.0	0.1	11.5	20.7	26.6
Latin America	6.2	14.7	27.9	61.5	12.1	15.4	10.4
Mediterranean-EC	178.9	406.1	530.0	1025.2	9.1	9.7	8.6
E.C.	0.7	2.8	5.7	12.6	15.2	16.1	10.3
Rest of Western Europe	0.2	0.3	1.3	0.6	5.4	9.2	-8.3
Middle East/North Africa	172.7	322.1	410.7	361.6	3.8	1.2	-1.6
Rest of Africa	35.7	59.1	103.6	83.5	4.3	3.5	-2.7
Far East	4.6	21.1	17.2	17.6	7.0	-1.8	0.2
Oceania	2.5	3.1	6.5	15.2	9.4	17.1	11.2
Communist Bloc	.0	0.4	0.8	3.9	28.7	25.0	21.9
World Total	448.7	948.6	1247.7	1814.7	7.2	6.7	4.8

Source: United Nations Trade Data Tapes.

Table 1.10 World Processed Orange Export Quantities by Region (Excluding Intraregional Trade)

Region	1978	1986	Annual Growth Rate 1978-86
	(000) 65 Degree Brix Metric Tons		Percent of Change
United States	148.1	76.4	-7.9
Canada	0.5	2.8	22.9
Latin America	296.1	827.8	13.7
Mediterranean-EC	28.9	33.3	1.8
E.C.	16.4	31.9	8.6
Rest of Western Europe	2.6	6.1	11.5
Middle East/North Africa	95.5	112.1	2.0
Rest of Africa	2.3	1.4	-5.7
Far East	0.5	2.2	19.4
Oceania	0.1	0.9	34.0
Communist Bloc	.0	0.3	39.4
World Total	591.0	1095.2	8.0

Source: United Nations Trade Data Tapes.

Table 1.11 World Processed Orange Export Values by Region (Excluding Intraregional Trade)

Region	1978	1986	Annual Growth Rate 1978-86
	In Millions of U.S. Dollars		Percent of Change
United States	98.0	66.6	-4.7
Canada	0.6	5.1	31.7
Latin America	298.6	671.8	11.1
Mediterranean-EC	23.4	32.9	4.4
E.C.	16.2	29.3	7.6
Rest of Western Europe	2.9	4.2	4.4
Middle East/North Africa	59.8	102.2	6.9
Rest of Africa	4.2	1.2	-14.2
Far East	0.3	1.5	23.0
Oceania	0.1	0.7	32.5
Communist Bloc	.0	0.2	52.4
World Total	494.1	915.8	8.0

Source: United Nations Trade Data Tapes.

Table 1.12 World Fresh Orange Import Quantities by Region (Excluding Intraregional Trade)

Region	1966	1976	1978	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86	Annual Growth Rate 1978-86
	----- (000) Metric Tons -----				--- Percent of Change ---		
United States	28.3	32.6	52.9	49.4	2.8	4.2	-0.8
Canada	180.5	225.5	180.2	182.1	.0	-2.1	0.1
Latin America	6.5	2.0	2.2	1.4	-7.5	-4.0	-5.9
Mediterranean-EC	0.0	0.7	1.5	8.0	N.A.	27.3	23.7
E.C.	2368.5	2623.3	2546.9	3290.7	1.7	2.3	3.3
Rest of Western Europe	383.7	434.6	433.2	550.2	1.8	2.4	3.0
Middle East/North Africa	11.4	129.4	72.2	54.9	8.2	-8.2	-3.4
Rest of Africa	8.8	5.1	8.7	6.1	-1.8	1.8	-4.3
Far East	77.8	161.1	162.0	310.9	7.2	6.8	8.5
Oceania	5.5	6.5	6.7	9.8	3.0	4.3	4.9
Communist Bloc	315.6	660.5	729.1	423.2	1.5	-4.4	-6.6
World Total	3386.6	4281.3	4195.5	4886.6	1.9	1.3	1.9

Source: United Nations Trade Data Tapes.

Table 1.13 World Fresh Orange Import Values by Region (Excluding Intraregional Trade)

Region	1966	1976	1978	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86	Annual Growth Rate 1978-86
	--- In Millions of U.S. Dollars ---				--- Percent of Change ---		
United States	3.7	8.8	14.2	28.9	10.8	12.6	9.3
Canada	38.6	99.1	76.7	133.1	6.4	3.0	7.1
Latin America	1.0	0.8	2.6	1.0	0.2	2.6	-11.1
Mediterranean-EC	.0	0.2	0.8	4.5	N.A.	38.4	24.7
E.C.	405.3	751.0	966.2	1367.7	6.3	6.2	4.4
Rest of Western Europe	68.7	153.1	198.4	333.9	8.2	8.1	6.7
Middle East/North Africa	1.1	44.3	28.0	14.5	13.6	-10.5	-7.8
Rest of Africa	3.0	2.8	4.5	6.2	3.7	8.4	3.9
Far East	19.1	66.0	97.4	241.1	13.5	13.8	12.0
Oceania	1.5	2.2	3.0	6.7	7.6	12.1	10.9
Communist Bloc	43.9	168.8	246.9	203.9	8.0	1.9	-2.4
World Total	586.0	1297.0	1638.6	2341.5	7.2	6.1	4.6

Source: United Nations Trade Data Tapes.

Table 1.14 World Processed Orange Import Quantities by Region (Excluding Intraregional Trade)

Region	1978	1986	Annual Growth Rate 1978-86
	(000) 65 Degree Brix Metric Tons		Percent of Change
United States	136 8	500.6	17.6
Canada	98.3	89.5	-1.2
Latin America	6.5	3.4	-7.8
Mediterranean-EC	3.8	16.6	20 1
E.C.	243.4	393.0	6.2
Rest of Western Europe	69.1	48.6	-4.3
Middle East/North Africa	13.7	9.8	-4 1
Rest of Africa	1 9	1.6	-2 5
Far East	11.3	25.0	10.4
Oceania	1.0	3.0	15.4
Communist Bloc	5.2	4.2	-2.6
World Total	591.0	1095.2	8.0

Source: United Nations Trade Data Tapes

Table 1.15 World Processed Orange Import Values by Region (Excluding Intraregional Trade)

Region	1978	1986	Annual Growth Rate 1978-86
	In Millions of U.S. Dollars		Percent of Change
United States	150.6	518.9	16.7
Canada	106.0	104.4	-0.2
Latin America	5 9	8.1	3.9
Mediterranean-EC	3.7	16.7	20 6
E.C.	230.2	414.1	7.6
Rest of Western Europe	83.0	55.0	-5 0
Middle East/North Africa	12.5	16.1	3 2
Rest of Africa	2.3	2.1	-1.3
Far East	19.5	49.5	12 4
Oceania	1.4	3.5	12.1
Communist Bloc	3.3	3 4	0.5
World Total	618.4	1191.9	8.5

Source: United Nations Trade Data Tapes.

World trade in the processed industry showed a higher average increase from 1978 to 1986, reaching 8.4% a year (see Tables 1.5 and 1.7). If interregional trade is not considered, the processed industry grew by 8% a year during the same period.

Tables 1.9, 1.11, 1.13, and 1.15 show world fresh and processed orange exports and imports excluding interregional trade. Trade is expressed in value terms measured in United States dollars.

The United States fresh orange production decreased at an average rate of .3% a year from 1966 to 1986. During the 1970s, production increased rapidly and later decreased mainly due to unfavorable weather conditions. Oranges used for fresh consumption decreased at a rate of .5% a year from 1966 to 1986. Total United States trade increased at a rate of 2.4% a year for the same period. This shows that the United States has actually decreased its real participation in world fresh utilization. It has increased the use of oranges in the processed industry, along with a slight increase in its role in the international trade arena for fresh oranges. In the processed industry, the United States has decreased its production participation relative to the rest of the world and passed from a net exporter to a net importer of FCOJ (Frozen Concentrated Orange Juice) (Tables 1.3, 1.5, and 1.7).

As shown in the different tables introduced in this chapter, in the last two decades trade patterns in the orange industry have changed dramatically. The United States, once the world's major producer of fresh oranges and orange juice, today is no longer the leading producer or exporter. Latin America, mainly Brazil, is the major producer of oranges in the world. Most of Brazil's production is used for FCOJ and is

exported. Per capita consumption of fresh oranges within Brazil is quite low. The Mediterranean countries are major producers and exporters of fresh oranges. The rest of Europe as well as Canada have always been net importers of fresh and processed oranges. Other regions, especially the Middle East/North Africa and the Far East, have increasingly become important producers and traders in the orange industry. Chapter 2 will outline production and trade flows of the fresh orange industry in more detail.

Problem and Objectives

World consumption trends indicate that consumers are interested in healthy and natural products. Fresh product consumption is increasing and its potential growth is promising. Given the changes in consumption patterns and the improvement in the transportation systems, studying the fresh markets is of increasing importance. Fresh oranges, in particular, provide consumers with natural flavor and important vitamins and minerals. Fresh oranges and FCOJ are direct substitutes in the supply decision process, but are not considered substitutes in the consumption side. Consumer satisfaction is considered to be different for each good. Most recent literature has studied mainly processed trade, which has been growing faster than fresh trade in the last two decades. However, the value and quantity of fresh trade are two and four times that for the processed trade, respectively (see Tables 1.8 to 1.15). World fresh utilization represents 65% of total orange production.

The discussion in the previous section described some of the factors affecting trade patterns and market shares of the fresh orange industry during the last 21 years. Even though the market has experienced important increases, several countries, including the United States, have experienced pronounced changes in their trade patterns for value and quantity. The dynamics of the marketplace are illustrated with participation of the Middle East/North Africa countries in the European market; Latin America's increasing share of the European market; the increasing portion of the United States in the Far East markets; the Middle East/North Africa's increasing participation as consumers of fresh and processed oranges; and the potential growth of China as a supplying and consuming country.

The fresh orange industry is quite important for some regions, especially for the United States, Latin America, Mediterranean-EC, Middle East/North Africa, and Far East, as producers, consumers, and exporters. Producers and exporters need to understand the major driving factors for fresh consumption and their competitive position in foreign markets. It will allow them to compete with more information, possibly achieve international success, and help to develop new markets. The fresh orange industry is also important for net importers such as Canada, EC, rest of Western Europe, and the Communist Bloc. These regions will be interested in knowing which are the major driving factors for fresh consumption, and demand and price linkages between the region and its major trading partners.

Given the changes in the fresh orange market, studying the world trade flows becomes important for the future of the United States orange

industry as well as for other partner regions. Modeling these changes is the major objective of this study. The analysis will provide information to help understand the reasons for changes in market shares among major suppliers and facilitate longer term forecasts and policy analyses.

To accomplish the objectives of the present study, international trade linkages among the major trading regions must be identified. It is also necessary to recognize the current and emerging problems in the industry. This information will be helpful to study changes in trade patterns arising from changes in supply and demand conditions and from changes in policy variables such as tariff levels and institutional constraints.

Analysis of the demand parameters will show the likely future direction of trade. Using price elasticities, it will be possible to predict responses in the different markets to changes in prices. The role of prices as an allocative tool can be shown. Income and population elasticities will give an indication of possible adjustments in consumption and trade patterns. In general, it will be possible to forecast trade patterns among importers and exporters. The system could be used to construct a sensitivity analysis to study the behavior of the fresh orange trade model given shocks in the different variables including price, market size, income, population, fresh production, tariff and nontariff barriers, and other variables.

The specific objectives of this research are:

1. Specify a multiple-region equilibrium world trade model for the fresh orange industry. Relative and substitute prices,

transportation costs, incomes, populations, exchange rates, and policy variables were considered.

2. Estimate the demand, export supply and price equations that explain the individual elements of the trade flows. A simultaneous system was specified and estimated.

3. Analyze the implications contained in the estimated model. The estimated parameters were used to study the reasons for changes in market shares and to provide information for specific policy issues.

4. Develop a sensitivity analysis of the model for the major trading regions under different economic scenarios. To make forecasts, exogenous changes in the different variables such as import and export price, market size, income, population, fresh production, tariffs and nontariff barriers, and other variables were considered.

Scope

The proposed study will develop a world trade model with demand and export supply equations for selected major trading regions. The model will include fresh oranges as defined by the United Nations Standard International Trade Classification (SITC) (1975) code 05711. Fresh oranges and orange juice are direct substitutes in the supply decision process but are not considered substitutes on the consumption side. To be complete, the model should take into consideration the supply relationship between the two goods. The end product model includes market size, market

and relative prices, transportation costs, tariff barriers (national or regional agricultural policies), price of substitutes, income levels, exchange rates, and population.

International trade data including value and quantity were obtained from United Nations' Commodity Trade Statistic Tapes (1987). These data are gathered by each member country and sent to the statistics office in New York. The data contain import and export value and quantity information for each member, showing the partner country. The price data used in this dissertation are unit prices obtained by dividing value by quantity for each trade flow. As expected, many errors were found. Most of them were probably related to gathering problems and inconsistencies. Where errors were detected, the data were corrected in what seemed to be an appropriate way. Tariff barriers were obtained from different sources. The kinds of tariffs differ from country to country, from an ad valorem basis, using CIF import prices or FOB export prices as a base, to fixed dollar amounts per ton. Tariffs were averaged using different methods to obtain the best possible regional tariff. Nontariff barriers are not considered in the study, given that most of them are seasonal and the model uses annual data. The period of study is 1966 to 1986.

Methodology

The present study develops a fresh orange multiple-region equilibrium world trade model. To ease the estimation and the analysis, world countries are aggregated into 11 regions The regions have been selected by considering similarities in supply and/or demand among the

countries and their importance in production and international trade in fresh oranges.

The model is a nonlinear simultaneous system of equations that contains 440 equations of which 242 were estimated. The equations to estimate were total market demands (one per region), export supplies (one per region), product demands (one per partner in each region), and price linkage equations (one per partner in each region). The rest of the equations in the model were identities.

A nonlinear simultaneous system estimator was used for the estimation of the model. Model results were analyzed to evaluate the fit of the model and its accuracy for simulation. The final model and its parameters were used to develop a sensitivity analysis to investigate the effects of changes in selected policy variables.

Overview

Chapter 2 discusses world production and trade flows for fresh oranges. Chapter 3 covers the literature review for agricultural trade and fresh orange trade models. Chapter 4 presents the fresh orange trade model to be estimated. Chapter 5 discusses the methods used for the estimation of the model. It also develops a graphical, statistical, and economic analysis for the results of the estimation. Chapter 6 develops the sensitivity analysis.

CHAPTER 2
FRESH ORANGE WORLD PRODUCTION AND TRADE

Introduction

This chapter discusses world production and trade flows of fresh oranges. The discussion will be based on several tables for 11 specified regions of the world. These regions were selected based on similarities of supply and demand conditions among the different countries included in each region with regard to the orange industry. The regions are the United States (US), Canada (CAN), Latin America (LA), Mediterranean-European Community countries (MED-EC), the rest of the European Community countries (EC), rest of Western Europe (RWE), Middle East/North Africa (ME/NA), rest of Africa (RAF), Far East (FE), Oceania (OCE), and Communist Bloc (COMMB). The Communist Bloc is defined as it existed before the political changes of 1991. Appendix A shows the countries included in each region.

Production Analysis

Table 2.1 shows the production levels of oranges in the 11 regions identified for 1966, 1976, and 1986. These years were selected to illustrate changes through time. World orange production increased at an annual rate of 3.3% in the last 20 years and increased at a rate of 1.9%

Table 2.1 World Orange Production By Region

Region	1966	1976	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86
	--- (000) Metric Tons	---		Percent of Change	
United States	7598	10183	7192	-0.3	-3.4
Canada	0	0	0	N.A.	N.A.
Latin America	5540	12117	18535	6.2	4.3
Mediterranean-EC	4208	5472	6840	2.5	2.3
E.C	4	31	34	11.3	0.9
Rest of Western Europe	0	0	0	N.A.	N.A.
Middle East/North Africa	3067	4664	5794	3.2	2.2
Rest of Africa	773	1034	1022	1.4	-0.1
Far East	4023	6532	8354	3.7	2.5
Oceania	249	360	574	4.3	4.8
Communist Bloc	192	292	728	6.9	9.6
World Total	25654	40685	49073	3.3	1.9

Source: FAO Production Yearbook Various issues.

in the last decade. Table 2.2 shows the portion of that production used as fresh product. Production utilization in fresh form decreased from 75.3% in 1966 to 65.4% in 1986 (compare data in Table 2.2 as a percent of the corresponding figures in 2.1).

Table 2.1 also shows that the major world producer was Latin America, with 21.6% in 1966, 29.8% in 1976, and 37.8% in 1986. This region exhibited one of the faster annual growth rates, 6.2% during the 20 year period. However, as shown in Table 2.2, over 50% of the oranges of this region went to the processed industry, leaving 9 4 million tons for fresh utilization in 1986. This represented 29.3% of total world fresh utilization.

The second largest producer of oranges was the Far East, with 15.7% in 1966, 16.1% in 1976, and 17% in 1986. These percentages show that the Far East region has not only maintained its participation in the total world production of oranges in the last 20 years, but has also increased it. Table 2.1 shows that the Far East region has doubled in absolute terms its total production in the same period. In addition, 91.2% of total production was used fresh in 1986.

The third largest producer was the United States, with 29.6% in 1966, 25% in 1976, and 14.7% in 1986. Even though the United States is still a major world producer, its share of total production of oranges has been decreasing, especially in the last decade The United States used most of its production in the processed industry. In 1986, 32.3% of total production was used fresh, indicating that the United States was not the third major supplier of oranges to the fresh markets.

Table 2.2 World Fresh Utilization by Region

Region	1966	1976	1986	Annual Growth Rate 1966-86	Annual Growth Rate 1976-86
	-- (000) Metric Tons ---			Percent of Change	
United States	2575	2294	2322	-0.5	0.1
Canada	0	0	0	N.A.	N.A
Latin America	5290	8336	9394	2.9	1.2
Mediterranean-EC	3689	4807	5787	2.3	1.9
E.C.	4	31	34	11.3	0.9
Rest of Western Europe	0	0	0	N.A.	N.A
Middle East/North Africa	2862	4273	5122	3.0	1.8
Rest of Africa	692	894	919	1.4	0.3
Far East	3801	5634	7619	3.5	3.1
Oceania	202	196	251	1.1	2.5
Communist Bloc	192	287	638	6.2	8.3
World Total	19307	26752	32086	2.6	1.8

In that year, the United States occupied the fifth position in fresh sales worldwide

The fourth largest producer of oranges was the Mediterranean-EC This region's share in world production of fresh oranges was 16.4% in 1966, 13.4% in 1976, and 13.9% in 1986. This region's production grew rapidly in the last decade. This growth coincided with the incorporation into the European Community (EC) of all the countries included in this particular region. The Mediterranean-EC dedicated 15.4% of its total orange production to the processed industry in 1986 Fresh utilization represented 18% of total world fresh orange production. The region occupied the third position in the fresh market in 1986.

The fifth major producer of oranges was the Middle East/North Africa, with 12.0% in 1966, 11.5% in 1976, and 11.8% in 1986 In 1986, 88 4% of total production was used fresh, giving the Middle East/North Africa region the fourth position in the world fresh orange market.

The rest of Africa was the sixth largest producer of oranges with 3.0% in 1966, 2.5% in 1976, and 2.1% in 1986. As shown in Table 2.2, out of total orange production, this region dedicated 10.1% to the processed industry in 1986. In that year, the region occupied the sixth position in fresh sales worldwide.

The rest of world production of oranges was provided by the Communist Bloc, Oceania, and the EC with .7%, 1.0%, and .02% in 1966 and 1.5%, 1.2%, and .1% in 1986, respectively. The Communist Bloc dedicated 99.1% of total production to the fresh orange industry in 1986, while in Oceania 43 7% of total production was used for fresh consumption.

Trade Flow Analysis

Table 2.3 shows the quantities traded between the 11 regions for 1966, 1976, and 1986. These years were selected to illustrate changes through time. The first column of this table represents the different years, the second column and the top row of the table represent the region and the partner region names, respectively. Each of the 11 columns depicts the quantities exported from the partner region to each region. The following two columns show the total product imported by each region, with the first one including the intraregional trade and the other including interregional trade. Since the first and second regions consist of a single country, both columns display the same values. The last two columns exhibit the percentages associated with the previous two columns in relation to total world imports. Similarly, the last four rows of the table contain total exports from each partner region. The first row includes intraregional trade, the second one only interregional trade, and the last two rows show the percentages associated with total world exports.

Tables 2.4 and 2.5 contain the percentages needed to illustrate the allocation of exports, imports, and trade flows in total and among the 11 regions. Table 2.4 shows the percentages from the exporter or partner region position and Table 2.5 from the importer or region perspective. In both tables, intraregional trade was excluded, given that the major interest of the present study has to do with trade among the regions. Intraregional quantities are part of the region's production that is consumed domestically.

Table 2 3 Trade Flow Analysis for Selected Years (1966, 1976 and 1986) by Region in Relation to Partner Regions

Year	Region	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMM	Total W/INTR*	Total W/O INTRA*	% W/INTR	% W/O INTR
[illegible]	US	[illegible]	[illegible]	23200	332	13	0	[illegible]	0	212	[illegible]	[illegible]	26340	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	952	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	20	0	9700	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	CAN	[illegible]	[illegible]	[illegible]	[illegible]	20	0	[illegible]	10100	[illegible]	30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	031	20	0	0	3220	[illegible]	23002	[illegible]	[illegible]	[illegible]	200001	[illegible]	[illegible]
[illegible]		123002	0	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	182102	[illegible]	[illegible]	[illegible]
[illegible]	LA	[illegible]	0	3001	[illegible]	[illegible]	0	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	0 3	0 3
[illegible]		[illegible]	[illegible]	10010	[illegible]	56	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10140	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	3	2055	[illegible]	[illegible]	0	10	[illegible]	[illegible]	[illegible]	400	3800	0052	[illegible]	[illegible]
[illegible]	MED-EC	0	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0 0
[illegible]		[illegible]	[illegible]	[illegible]	103	353	28	030	[illegible]	[illegible]	[illegible]	[illegible]	900	[illegible]	[illegible]	0 0
[illegible]		[illegible]	[illegible]	[illegible]	200	3000	158	087	0326	[illegible]	[illegible]	[illegible]	8243	[illegible]	[illegible]	0 2
[illegible]	EC	56040	62	66000	[illegible]	20055	[illegible]	[illegible]	013020	[illegible]	0300	[illegible]	2308400	[illegible]	66 [illegible]	[illegible]
[illegible]		104350	2	30303	0510400	010030	011	[illegible]	[illegible]	30	0005	[illegible]	[illegible]	2630253	54 [illegible]	[illegible]
[illegible]		0330	232	[illegible]	2217600	003000	637	[illegible]	[illegible]	56	0025	11600	3084566	3260010	64 2	01 3
[illegible]	RWE	[illegible]	0	2000	220000	[illegible]	010	[illegible]	10020	022	[illegible]	[illegible]	304040	[illegible]	[illegible]	11 3
[illegible]		0700	0	2000	101200	3310	[illegible]	003024	24400	[illegible]	[illegible]	52	[illegible]	430000	[illegible]	[illegible]
[illegible]		1010	0	[illegible]	021300	[illegible]	0003	[illegible]	11922	30	200	260	051243	[illegible]	10 2	01 3
[illegible]	ME/NA	07	0	[illegible]	1020	[illegible]	0	00012	[illegible]	[illegible]	500	[illegible]	32040	[illegible]	0 0	0 3
[illegible]		20	[illegible]	005	20400	[illegible]	02	450000	54334	00300	[illegible]	[illegible]	[illegible]	120302	[illegible]	[illegible]
[illegible]		15	[illegible]	3203	06333	[illegible]	0	200000	0	20000	0054	[illegible]	[illegible]	00032	[illegible]	[illegible]
[illegible]	RAF	54	0	[illegible]	[illegible]	0005	[illegible]	0020	1164	2	[illegible]	[illegible]	10303	0020	0 3	0 3
[illegible]		[illegible]	[illegible]	100	100	002	[illegible]	3030	5403	50	[illegible]	[illegible]	10050	[illegible]	0 2	[illegible]
[illegible]		0	[illegible]	[illegible]	[illegible]	001	0	[illegible]	2110	[illegible]	[illegible]	[illegible]	3200	0092	0 2	[illegible]
[illegible]	FE	[illegible]	[illegible]	[illegible]	300	[illegible]	10	[illegible]	05400	40505	0004	[illegible]	119300	00030	[illegible]	2 3
[illegible]		[illegible]	[illegible]	[illegible]	920	5	0	[illegible]	1100	00020	0052	3	[illegible]	001000	[illegible]	[illegible]
[illegible]		201010	[illegible]	320	1630	53	0	[illegible]	[illegible]	01030	20210	0	042030	300000	[illegible]	[illegible]
[illegible]	OCE	2210	[illegible]	1030	[illegible]	0	0	0010	220	[illegible]	0043	[illegible]	10300	5413	[illegible]	0 2
[illegible]		8400	[illegible]	0	[illegible]	0	0	23	[illegible]	[illegible]	2003	[illegible]	[illegible]	8403	[illegible]	[illegible]
[illegible]		9802	[illegible]	[illegible]	[illegible]	[illegible]	0	0	[illegible]	5	00540	0	20003	0410	[illegible]	[illegible]
[illegible]	COMM	0040	0	0030	066050	004	2	030001	[illegible]	10	[illegible]	[illegible]	310000	305000	[illegible]	0.3
[illegible]		0100	[illegible]	20203	212230	003	0	[illegible]	[illegible]	0	[illegible]	00300	010000	600010	14.0	[illegible]
[illegible]		0	[illegible]	12603	241100	0005	010	[illegible]	[illegible]	[illegible]	[illegible]	22600	[illegible]	030100	0 3	[illegible]

Table 2 3--continued.

Year	Region	US	CAN	LA	MED EC	EC	RWE	ME/MA	RAF	RE	OCE	COMM	Total W/INTR[a]	Total W/O INTRA[b]	% W/INTR	% W/O INTR
66	Total	251506	11	116511	1514551	32111	3016	1115875	164425	65111	23515	111	3164111	3386816	100 8	100 1
70	W/INTR	164611	58	110111	1031110	122551	5826	1111656	265700	112311	11156	60356	5020813	1281333	100 1	100 1
84		113612	268	221315	2833110	104110	2182	1310721	218113	113811	11111	35010	5385620	1866611	100 1	101.1
66	Total	256506	71	103311	1511557	2111	1116	1115263	262811	21215	13112	111	3386810			
70	W/O INTR	164011	58	113116	1037311	8011	150	1110648	280211	64413	1111	3131	1281333			
84		113612	268	226180	3633151	21113	1110	1082643	206111	11131	31113	13390	1868108			
66	% W/INTR	1 1	0	3 1	13 5	8 0	1 1	31 0	1 1	1 1	1 7	1	100 0			
70		0 2	0	3 1	31 0	2 1	0 1	37 3	5 1	2 1	1 2	1 3	100 0			
84		1 1	0	1 3	52.5	3.8	0	24 4	3 0	2 1	1 0	1.8	101.1			
66	% W/O INTR	1 0	0	3.1	11 7	0.1	.0	35 0	1 6	0.1	1 1	.1	101.1			
70		10 1	0	2 1	15 5	0 2	0	33 0	0 6	1 5	1 2	1	100 1			
84		0 5	0	1.6	51 0	0.1	.0	22 4	4 2	0 1	1 0	0.3	101.1			

[a]Total includes intraregional trade
[b]Total does not include intraregional trade

Table 2.4 Trade Flow Analysis for Selected Years (1966, 1976 and 1986) Without Intraregional Trade "Relative Partner Region Exports by Region"

Year	Region	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMU
						- - - - - Percentages - - - - -						
66	US	0.0	0.0	22.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
76		0.0	10.0	30.2	0.0	0.1	0.0	0.0	0.0	1.5	1.0	0.0
86		0.0	7.1	6.0	0.0	0.1	0.0	0.0	0.0	3.5	0.0	0.0
66	CAN	58.0	0.0	1.5	0.0	0.7	0.0	0.7	0.1	50.0	0.0	0.0
76		41.1	0.0	0.2	0.0	0.0	0.0	0.2	2.0	35.0	18.5	0.0
86		88.0	0.0	2.0	0.7	0.0	0.0	2.0	0.0	85.7	5.0	0.0
66	LA	2.5	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0
76		0.0	77.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
86		0.1	1.1	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0
66	MED-EC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
76		0.0	0.0	0.0	0.0	2.0	3.3	0.0	0.0	0.0	0.0	0.0
86		0.0	0.0	0.0	0.0	15.0	16.2	0.0	1.0	0.0	0.0	0.1
66	EC	21.7	67.0	87.2	73.7	0.0	88.1	75.3	81.4	0.1	24.0	11.2
76		22.5	3.0	38.1	78.0	0.0	85.1	53.0	70.5	0.1	23.0	87.0
86		2.3	66.6	77.6	78.3	0.0	57.0	83.7	85.0	0.1	5.0	88.1
66	RWE	3.0	0.0	2.0	15.0	51.5	0.0	10.1	6.5	1.7	3.1	88.0
76		1.0	0.0	2.0	8.2	38.5	0.0	15.0	7.0	0.0	21.1	2.0
86		0.0	0.0	0.7	31.3	78.2	0.0	17.1	6.7	0.1	0.6	2.1
66	ME/NA	0.0	0.0	0.0	0.1	0.6	0.0	0.0	0.0	88.0	4.2	0.0
76		0.0	0.0	0.1	1.5	52.0	1.0	0.0	16.0	62.8	0.0	0.0
86		0.0	0.0	1.0	0.0	0.5	0.0	0.0	0.0	70.5	15.0	0.0
66	RAF	0.0	0.0	0.0	0.0	30.0	0.0	0.0	0.0	0.0	2.2	0.0
76		0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	6.1	0.0	0.0
86		0.0	0.0	0.0	0.0	3.0	0.0	0.4	0.0	0.0	1.5	0.0
66	FE	16.0	12.7	0.0	0.0	0.0	1.7	1.1	5.0	0.0	65.0	0.0
76		31.5	0.0	0.0	0.0	0.1	0.0	0.7	0.4	0.0	35.0	0.1
86		88.0	5.2	0.1	0.1	0.3	0.0	0.5	0.3	0.0	71.4	0.0
66	OCE	0.0	0.0	1.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
76		1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86		2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66	COMMU	1.0	0.0	0.0	11.0	6.0	0.2	11.0	0.0	0.0	0.0	0.0
76		0.1	0.0	26.0	11.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0
86		0.0	0.0	5.0	8.5	0.0	28.3	15.3	0.0	0.0	0.1	0.0
66	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
76		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
86		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 2.5 Trade Flow Analysis for Selected Years (1966, 1976 and 1986) Without Intraregional Trade "Relative Region Imports from Partner Regions"

Year	Region	US	CAN	LA	MED-EC	EC	NWE	ME/NA	RAF	FE	OCE	COMMB	Total
							- - - - - Percentages - - - - -						
66	US	0.0	0.0	82.1	0.0	0.0	0.0	10.3	0.0	0.7	0.0	0.0	100.0
76		0.0	0.0	85.2	0.0	0.0	0.0	0.6	0.0	2.8	0.3	0.0	100.0
86		0.0	0.0	45.2	32.0	0.1	0.0	18.7	0.0	3.0	0.0	0.0	100.0
66	CAN	77.8	0.0	0.0	0.0	0.0	0.0	4.7	0.0	7.8	0.0	0.0	100.0
76		84.7	0.0	0.1	0.0	0.0	0.0	1.4	2.8	10.2	0.7	0.0	100.0
86		[illegible]	0.0	3.8	10.2	0.0	0.0	11.0	0.0	5.0	1.2	0.0	100.0
66	LA	[illegible]	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	100.0
76		84.0	2.2	0.0	0.0	2.8	0.1	0.0	0.0	0.0	0.0	0.0	100.0
86		43.8	0.2	0.0	4.5	18.1	0.0	1.3	0.3	1.2	0.0	33.4	100.0
66	MED-EC	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
76		1.0	0.0	0.0	0.0	35.3	3.0	58.8	0.0	0.0	0.0	0.0	100.0
86		0.0	0.0	10.4	0.0	38.7	2.0	8.2	41.7	0.0	0.0	0.1	100.0
66	EC	2.4	0.0	3.9	47.1	0.0	0.0	38.3	8.0	0.0	0.1	0.0	100.0
76		4.0	0.0	1.5	57.8	0.0	0.0	28.0	7.5	0.0	0.1	0.1	100.0
86		0.2	0.0	5.4	67.4	0.0	0.0	21.2	5.4	0.0	0.1	0.4	100.0
66	NWE	2.0	0.0	0.8	58.8	0.4	0.0	31.7	4.4	0.1	0.1	0.0	100.0
76		1.1	0.0	0.7	40.8	0.8	0.0	51.5	4.8	0.0	0.4	0.0	100.0
86		0.3	0.0	1.1	[illegible]	2.8	0.0	34.0	3.3	0.0	0.1	0.0	100.0
66	ME/NA	0.1	0.0	0.0	8.0	0.1	0.0	0.0	0.0	85.7	5.1	0.0	100.0
76		0.0	0.0	0.1	22.8	3.8	0.0	0.0	42.0	31.2	0.0	0.0	100.0
86		0.0	0.0	5.8	28.7	0.2	0.0	0.0	0.0	53.0	10.3	0.0	100.0
66	RAF	0.0	0.0	0.1	1.1	11.8	0.0	83.0	0.0	0.0	3.4	0.0	100.0
76		0.1	0.0	3.5	14.1	8.3	0.0	71.2	0.0	1.1	0.7	0.0	100.0
86		0.0	0.0	0.1	0.0	12.5	0.0	78.5	0.0	0.0	4.8	0.0	100.0
66	FE	48.5	0.0	0.0	0.5	0.0	0.0	17.8	18.8	0.0	11.5	0.0	100.0
76		90.8	0.0	0.0	0.0	0.0	0.0	6.2	0.7	0.0	1.8	0.0	100.0
86		80.2	0.0	0.1	0.5	0.0	0.0	1.8	2.8	0.0	0.4	0.0	100.0
66	OCE	40.4	0.0	25.8	0.0	0.0	0.0	28.0	4.1	0.0	0.0	0.0	100.0
76		[illegible]	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	100.0
86		86.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	100.0
66	COMMB	1.0	0.0	1.3	52.8	0.1	0.0	44.2	0.0	0.0	0.0	0.0	100.0
76		1.5	0.0	4.4	32.1	0.1	0.0	61.8	0.0	0.0	0.0	0.0	100.0
86		0.0	0.0	3.0	57.1	0.2	0.1	38.8	0.0	0.0	0.0	0.0	100.0

Tables 2.6, 2.7, and 2.8 correspond to the same characteristics described for Tables 2.3, 2.4, and 2.5, respectively. The difference between these two sets of tables is that the former tables present cumulative information for five years instead of yearly information. The periods considered are 1966 to 1970, 1974 to 1978, and 1982 to 1986 The discussion that follows will be based mainly on the first set of tables, because both sets draw similar conclusions. However, given that yearly information could be biased for uncommon reasons, the results in Table 2.6 to 2.8 are useful to support general conclusions.

Partner Region Perspective

In this section, the discussion will be oriented from the exporters' viewpoint In all cases, the relative importance of each region is set forth and then a trade flow analysis is developed.

Table 2.3 shows that the world's major fresh orange exporter was the Mediterranean-EC region. With intraregional trade considered, this region's share of total exports was 43.5% in 1966, 38.6% in 1976, and 52.5% in 1986. With intraregional trade not considered, the relative importance of the region in world trade increased to 44.7%, 45.3%, and 58% respectively. These values show the importance of this region in world trade of fresh oranges

Table 2.4 shows that the major partner of the Mediterranean-EC was the EC region In 1966, 73.7% of the Mediterranean-EC region's total exports went to the EC region. This percentage increased to 78.3 in 1976 and was the same in 1986. The EC region includes all EC countries except

Table 2.6 Trade Flow Analysis for Selected Periods of Five Years (1966-70, 1974-78 and 1982-86)

Period	Region	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMM	Total W/INTR	Total W/O INTR	% W/INTR	% W/O INTR
								- - - - - Metric to U.S - - - - -								
P1*	US	[illegible]	[illegible]	[illegible]	[illegible]	25	0	20283	[illegible]	[illegible]	[illegible]	0	259554	[illegible]	[illegible]	[illegible]
P2*		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	205830	[illegible]	[illegible]
P3*		[illegible]	[illegible]	[illegible]	[illegible]	200	0	[illegible]	10	[illegible]	[illegible]	0	202566	[illegible]	[illegible]	[illegible]
P1	CAN	[illegible]	0	[illegible]	[illegible]	133	0	20054	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]
P2		[illegible]	0	2100	200	50	0	20021	20041	[illegible]	[illegible]	0	[illegible]	1000202	[illegible]	[illegible]
P3		600202	0	22100	30000	[illegible]	0	[illegible]	0	[illegible]	[illegible]	0	945100	[illegible]	[illegible]	[illegible]
P1	LA	16000	05	[illegible]	2	500	0	012	[illegible]	2	0	[illegible]	50010	[illegible]	[illegible]	[illegible]
P2		[illegible]	05	[illegible]	0	220	2	10	[illegible]	0	2	2	[illegible]	8450	[illegible]	[illegible]
P3		[illegible]	[illegible]	[illegible]	202	1000	0	220	20	[illegible]	20	1002	[illegible]	[illegible]	0.5	[illegible]
P1	MED-EC	2	0	83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	[illegible]	2850	1842	[illegible]	[illegible]
P2		[illegible]	0	10	200	1300	[illegible]	2202	22	[illegible]	0	[illegible]	[illegible]	2638	[illegible]	[illegible]
P3		[illegible]	0	[illegible]	5000	05102	[illegible]	[illegible]	5026	[illegible]	0	100	05983	22520	0 2	[illegible]
P1	EC	261000	120	200240	[illegible]	206040	2320	[illegible]	[illegible]	052	[illegible]	1330	[illegible]	[illegible]	[illegible]	[illegible]
P2		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2100007	[illegible]	200	[illegible]	11040	[illegible]	12005304	54	[illegible]
P3		[illegible]	200	500010	[illegible]	[illegible]	[illegible]	[illegible]	005683	[illegible]	[illegible]	51000	[illegible]	13006340	[illegible]	[illegible]
P1	RWE	[illegible]	0	20030	[illegible]	19400	6000	780000	[illegible]	[illegible]	0054	1600	[illegible]	1001010	[illegible]	[illegible]
P2		26000	0	20100	[illegible]	24080	23040	1120003	000512	[illegible]	0224	[illegible]	2215930	2002000	[illegible]	10
P3		0200	[illegible]	20512	0010020	05240	[illegible]	[illegible]	005954	[illegible]	0510	[illegible]	[illegible]	2000102	[illegible]	10
P1	ME/NA	05	0	[illegible]	2220	200	1100	[illegible]	0845	22000	0100	0	523200	02202	2	0.2
P2		10020	0	20110	04002	12200	10000	2000002	000202	202055	00104	[illegible]	2526300	[illegible]	10 2	2.0
P3		2000	0	020028	05005	[illegible]	1400	1000230	08428	[illegible]	20000	[illegible]	[illegible]	[illegible]	[illegible]	2 2
P1	RAF	[illegible]	0	2160	005	0100	0	20104	00001	10	1000	[illegible]	05402	02402	0 2	0 2
P2		[illegible]	0	2230	3000	3600	05	20020	21630	[illegible]	130	[illegible]	50200	01005	0 2	0 1
P3		[illegible]	0	506	2002	[illegible]	0	22544	11020	10	2000	[illegible]	06200	24000	0.2	0.2
P1	FE	220005	[illegible]	0938	2220	500	05	00203	01400	200000	[illegible]	0	700002	[illegible]	2	2.3
P2		053400	1201	581	4001	[illegible]	5	50024	11860	200008	20852	02	1134000	[illegible]	[illegible]	[illegible]
P3		0213000	[illegible]	[illegible]	0258	300	20	[illegible]	00106	200202	00040	20	1152600	[illegible]	[illegible]	[illegible]
P1	OCE	10100	0	0020	20	0	0	[illegible]	1906	1	00100	0	10050	20000	0.0	0.1
P2		05305	0	900	0	0	0	103	1224	5	20260	0	[illegible]	01000	0 2	0 2
P3		51020	0	0	3002	20	0	010	1200	202	42036	0	100000	02220	0.0	0.0

Table 2.6--continued.

Period	Region	US	CAN	LA	MED-EC	EC	EME	ME/NA	RAF	FE	OCE	COMM	Total W/INTR[a]	Total W/O INTR[b]	% W/INTR	% W/O INTR
							- - - - - Metric to U S. - - - - -									
F0	COMM	00202	0	20000	040520	0262	00	1000007	247	000	70	230	1000001	1000021	00 0	01 3
02		30010	0	020000	0100046	0700	200	2080000	0	752	0	221000	0022057	2002050	10.2	11 3
F3		0	0	20227	012000	2000	1070	0071077	40	1	00	000225	2202010	2113000	0 0	10 3
00	TOTAL	1200000	270	000050	7074000	207200	00000	7000200	0200100	302501	000100	2210	10700040	17010507	100.0	000 0
F2	W/INTR	2000450	0007	700002	0302011	010170	30052	0005000	1200011	000001	00132	200000	20460702	21020400	100 0	000 0
03		2000720	000	0020630	00107562	020624	10043	7051100	1020010	000000	171150	060004	20010010	20014000	100 0	000 0
00	TOTAL	0200000	270	000100	7013200	07200	0070	0005220	1200120	100005	64500	2000	07010017			
F2	W/O INTR	2000450	1007	000007	0093100	00000	10300	7294342	1000210	014200	01030	02000	21320000			
F3		2000720	500	1070700	00164200	92000	1200	0770000	1007100	240720	100000	00170	20000002			
F0	% W/INTR	0.7	0 0	0 0	30 2	0 0	0 0	30 0	7 0	2 1	0 0	0 0	100.0			
F2		0.2	0 0	0 0	37 0	2 5	0 2	30 0	5 0	2 0	0 4	1 0	000 0			
F3		0 7	0 0	0 0	02.2	2.5	0.0	30.2	0 4	2.0	0 0	0 7	000 0			
F0	% W/O INTR	7 2	0 0	0 4	00.0	0 0	0.0	30.2	7 0	0.0	0 0	0 0	000 0			
F2		0 0	0 0	0 0	00.1	0 2	0 0	34 7	0 0	0 5	0 3	0 0	100 0			
F3		0 0	0 0	5 2	00 3	0 0	0.0	20.0	0 0	1.2	0 7	0 2	000 0			

[a]Total includes intraregional trade
[b]Total does not include intraregional trade
[c]Represents period from [illegible]-70
[d]Represents period from [illegible] 78
[e]Represents period from [illegible]-86.

Table 2.7 Trade Flow Analysis for Selected Periods of Five Years, (1966-70, 1974-78 and 1982-86) Without Intraregional Trade "Relative Partner Region Exports by Region"

Period	Region	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
						- - - - - Percentages - - - - -						
P1[a]	US	0.0	10.0	37.2	0.0	0.1	0.0	0.3	0.0	2.1	0.1	0.0
P2[b]		0.0	3.3	27.0	0.0	0.1	0.0	0.2	0.0	1.0	0.2	0.0
P3[c]		0.0	27.5	10.3	0.0	0.2	0.0	0.0	0.0	2.3	0.3	0.0
P1	CAN	33.3	0.0	2.0	0.0	0.0	0.0	0.3	3.3	73.3	2.0	0.0
P2		62.0	0.0	0.0	0.0	0.1	0.0	0.0	2.7	20.0	23.1	0.0
P3		30.1	0.0	2.1	0.0	0.1	0.0	1.7	0.0	30.0	0.0	0.0
P1	LA	1.3	30.3	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0
P2		0.0	3.2	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
P3		0.0	1.2	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	3.0
P1	MED-EC	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0
P2		0.0	0.0	0.0	0.0	3.0	0.3	0.0	0.0	0.0	0.0	0.0
P3		0.0	0.0	0.0	0.0	17.1	0.1	0.0	0.0	0.0	0.0	0.3
P1	EC	20.7	40.2	68.3	76.0	0.0	72.0	70.1	63.0	0.3	17.0	60.0
P2		10.0	0.3	63.0	77.0	0.0	23.0	31.0	77.2	0.1	17.4	82.3
P3		2.0	52.0	64.0	70.0	0.0	30.0	30.7	70.3	0.2	3.0	96.3
P1	RWE	2.0	0.0	0.1	16.0	60.3	0.0	11.0	0.0	0.0	1.0	33.0
P2		1.3	0.0	3.0	0.2	55.0	0.0	13.2	0.0	0.0	11.7	0.0
P3		0.4	1.3	1.0	10.0	70.0	0.0	10.0	10.4	0.3	1.1	1.2
P1	ME/NA	0.0	0.0	0.0	0.0	1.0	25.5	0.0	0.0	22.0	1.0	0.0
P2		0.7	0.0	3.3	0.0	20.2	73.0	0.0	10.3	80.1	17.3	0.3
P3		0.1	0.0	11.7	0.3	0.0	10.2	0.0	0.7	80.2	13.2	0.0
P1	RAF	0.0	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	2.1	1.0
P2		0.0	0.0	0.3	0.0	8.4	0.3	0.3	0.0	0.0	0.2	0.0
P3		0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	2.1	0.0
P1	FE	18.1	3.3	1.2	0.0	2.0	1.2	1.2	3.2	0.0	70.3	0.0
P2		31.0	80.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	40.1	0.1
P3		30.3	17.0	0.2	0.1	0.0	0.3	0.7	3.0	0.0	60.0	0.0
P1	OCE	0.0	0.0	1.1	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0
P2		2.2	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
P3		2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
P1	COMMB	1.1	0.0	3.1	11.3	7.3	0.0	13.8	0.0	0.0	0.1	0.0
P2		1.0	0.0	10.3	12.3	0.0	2.2	32.0	0.0	0.2	0.0	0.0
P1		0.0	0.0	2.3	0.0	3.0	14.7	20.3	0.0	0.0	0.0	0.0
P1	TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
P2		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
P3		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Represents period from 1966-70.
[b]Represents period from 1974-78.
[c]Represents period from 1982-86

Table 2.8 Trade Flow Analysis for Selected Periods of Five Years (1966-70, 1974-78 and 1982-86) Without Intraregional Trade "Relative Region Imports from Partner Regions"

Period	Region	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FZ	OCE	COMMB	Total
		- - - - - Percentages - - - - -											
P1a	US	0.0	0.0	85.2	0.2	0.0	0.0	13.6	0.1	0.8	0.0	0.0	100.0
P2b		0.0	0.0	88.1	0.2	0.0	0.0	7.0	0.0	2.1	0.0	0.0	100.0
P3c		0.0	0.1	73.1	8.7	0.1	0.0	14.3	0.0	2.5	0.3	0.0	100.0
P1	CAN	78.1	0.0	1.7	0.2	0.0	0.0	4.1	7.0	8.2	0.1	0.0	100.0
P2		83.8	0.0	0.3	0.0	0.0	0.0	2.5	3.5	8.0	0.0	0.0	100.0
P3		75.0	0.0	2.3	4.2	0.0	0.0	10.4	0.0	8.0	1.1	0.0	100.0
P1	LA	81.7	0.5	0.0	0.0	2.3	0.0	4.5	0.0	0.0	0.0	0.0	100.0
P2		96.0	0.5	0.0	0.0	2.5	0.0	0.2	0.0	0.0	0.0	0.0	100.0
P3		70.0	0.1	0.0	1.0	13.2	0.0	2.0	0.3	0.2	0.2	10.0	100.0
P1	MED-EC	0.2	0.0	4.3	0.0	2.0	0.2	93.7	0.0	0.0	0.0	0.0	100.0
P2		0.2	0.0	0.4	0.0	18.1	2.1	80.5	0.0	0.0	0.0	0.0	100.0
P3		0.0	0.0	28.0	0.0	48.0	1.4	5.8	17.0	0.0	0.0	0.8	100.0
P1	EC	2.2	0.0	2.4	45.0	0.0	0.0	40.5	0.0	0.0	0.1	0.0	100.0
P2		3.0	0.0	2.4	56.8	0.0	0.0	26.3	8.2	0.0	0.1	0.1	100.0
P3		0.4	0.0	5.3	81.7	0.0	0.0	20.2	5.0	0.0	0.0	0.4	100.0
P1	RWE	1.5	0.0	1.2	51.0	0.5	0.0	30.4	5.2	0.0	0.1	0.1	100.0
P2		1.2	0.0	0.0	38.0	1.1	0.0	51.4	5.4	0.1	0.3	0.0	100.0
P3		0.4	0.0	0.0	40.0	2.0	0.0	44.0	4.8	0.1	0.1	0.0	100.0
P1	ME/NA	0.2	0.0	0.0	7.2	0.0	2.0	0.0	14.4	70.2	5.5	0.0	100.0
P3		3.1	0.0	4.8	11.2	2.5	3.2	0.0	29.0	44.1	2.2	0.0	100.0
P3		0.5	0.0	28.0	10.2	0.2	0.3	0.0	18.7	30.0	4.5	0.0	100.0
P1	RAF	0.2	0.0	0.7	1.2	12.0	0.0	74.8	0.0	0.0	4.2	0.1	100.0
P2		0.1	0.0	7.1	11.0	11.5	0.1	68.3	0.0	0.5	0.4	0.0	100.0
P3		0.0	0.0	1.4	8.5	14.0	0.0	67.3	0.0	0.0	8.0	0.0	100.0
P1	FZ	55.0	0.0	1.7	0.5	0.1	0.0	10.9	10.2	0.0	11.8	0.0	100.0
P2		80.2	0.2	0.1	0.0	0.0	0.0	0.1	1.0	0.0	3.1	0.0	100.0
P3		81.0	0.0	0.1	0.4	0.0	0.0	2.9	2.0	0.0	0.7	0.0	100.0
P1	OCE	41.4	0.0	27.0	0.1	0.0	0.0	32.5	8.1	0.0	0.0	0.0	100.0
P2		85.0	0.0	2.0	0.0	0.0	0.0	0.4	2.0	0.0	0.0	0.0	100.0
P3		92.1	0.0	0.0	4.0	0.0	0.0	0.7	1.0	0.4	0.0	0.0	100.0
P1	COMMB	0.7	0.0	1.5	42.7	0.1	0.0	54.0	0.0	0.0	0.0	0.0	100.0
P2		1.0	0.0	3.5	31.3	0.0	0.0	64.1	0.0	0.0	0.0	0.0	100.0
P3		0.0	0.0	1.1	43.2	0.1	0.1	55.4	0.0	0.0	0.0	0.0	100.0

[a]Represents period from 1966-70
[b]Represents period from 1974-78
[c]Represents period from 1982-86

Spain, Italy, Portugal, and Greece. The second largest partner of the Mediterranean-EC was the rest of Western Europe. Table 2.4 shows that the relative importance of the rest of Western Europe in the Mediterranean-EC's total exports decreased from 15.2% in 1966 to 11.3% in 1986. The third major partner of the Mediterranean-EC region was the Communist Bloc. This region accounted for 11.0% of the Mediterranean-EC's total exports in 1966 and 8.5% in 1986. Exports to the rest of the partners were small, but exports to the United States and Canada have increased in the last few years.

The second major exporter region of the world was the Middle East/North Africa. As opposed to the Mediterranean-EC region, this one has been losing its share of the market in the last 20 years. Participation in total world exports increased from 34.9% in 1966 to 37.3% in 1976 (see Table 2.3). Nevertheless, the region's share of the export market decreased to 24.4% in 1986. Examining exports without considering intraregional trade shows that this region was losing its share of the external market faster than its own regional market share. Table 2.3 shows that interregional percentages of the Middle East/North Africa decreased from 35.6 in 1966 to 22.4 in 1986.

The Middle East/North Africa region's major partner was the EC region. In 1966, 75.3% of total interregional exports from the Middle East/North Africa countries went to the EC countries (see Table 2.4). This percentage has since been decreasing, and in 1986 it represented only 63.7. In 1976, the percentage was lower, mainly due to an important shift of exports to the Communist Bloc. The second and third largest partner positions of the Middle East/North Africa region were closely shared by

two regions, the rest of Western Europe and the Communist Bloc. Exports from the Middle East/North Africa region to the rest of Western Europe represented 10.1% in 1966, 15.9% in 1976, and 17.1% in 1986. Exports to the Communist Bloc region represented 11.6%, 29.0% and 15.3% in the same years. Exports from the Middle East/North Africa region to the United States and Canada decreased from 1966 to 1976; however, exports to these countries have been increasing in recent years.

United States exports increased at a rate of 2.25% a year from 1966 to 1986. In relative terms, United States participation in world trade of fresh oranges showed about the same level as 1966. Total United States trade represented 7.4% of total world trade in 1966, increased to 9.2% in 1976 and decreased to 7.7% in 1986 (see Table 2.3). With intraregional trade not considered, the relative importance of the United States trade in the world trade increased. Table 2.3 shows that United States trade represented 7.6% in 1966, 10.8% in 1976, and 8.5% in 1986. In relative terms, these percentages show the United States to have been the third largest exporter, exceeded by the Mediterranean-EC and the Middle East/North Africa regions. In absolute terms, the Mediterranean-EC and the Middle East/North Africa exports were 6.9 and 2.6 times the United States exports, respectively, in 1986.

The relative importance of the United States partners has been changing through the years. The major United States partner in 1966 was Canada. Exports to Canada accounted for 54.3% of United States fresh exports that year (see Table 2.4). The second largest partner was the EC with 21.7% and the third largest was the Far East with 14.9%. Latin America, rest of Western Europe, Oceania, and the Communist Bloc absorbed

2.5%, 3.5%, .9% and 1.9%, respectively. By 1976, Canada represented 41.1%, the EC region stayed almost the same, and the Far East region absorbed 31.5% of the total United States fresh exports. In 1986, United States exports to the Far East reached 64.9% of its total volume, representing an important shift of the United States export partners. The second largest partner was Canada, with 30% of the total volume. The EC was no longer significant for the United States exports, given that it represented only 2.3% in the same year. The rest of the regions also decreased their participation relative to previous years.

Table 2.3 shows that exports from Latin America have doubled in absolute terms in the last two decades. However, exports did not increase from 1966 to 1976, which implies that the increase took place during the last ten years. Total world trade participation of Latin America passed from 3.1% in 1966 to 2.4% in 1976 and 4.3% in 1986. With interregional trade excluded, its participation in world fresh trade increased to 4.6% in 1986. Note that Brazil generally does not export fresh oranges.

The major export market for Latin American product has been the EC region, which in 1966 absorbed 67.2% of the total product exported (see Table 2.4). This percentage decreased to 38.1 in 1976 and increased to 77.6 in 1986. The United States was the second largest market for Latin America exports in 1966, with 22.5% of the total export level. This percentage increased slightly in 1976 and decreased to 9.8 in 1986. The third largest market for Latin America was the Communist Bloc, which took most of the reduction shown in the EC region during the 1970s and part of the United States share in the 1980s. Latin American exports to Canada and the Middle East/North Africa have been increasing, especially in the

last decade. Some countries of the Middle East/North Africa region utilized the fresh product to produce Frozen Concentrated Orange Juice (FCOJ). The rest of Western Europe is another important market for the Latin American product. An interesting issue about this region is that its percentage of participation has not changed significantly over the years.

The rest of Africa used to be the third largest exporter of the world, but its share of the market has been decreasing, especially from 1976 to 1986. With interregional trade considered, this region's share of the world's export market was 7.6% in 1966, 5.7% in 1976, and 3.9% in 1986 (see Table 2.3). Given that most of its trade was external, these percentages increased to 7.8, 6.5, and 4.2, respectively, when only interregional trade is considered. The region's share of the market indicates that it occupied the fifth position relative to the other regions in 1986.

The major export market for the rest of Africa was the EC region. This region represented 81.4%, 70.5% and 85.4% of the total rest of Africa exports in 1966, 1976, and 1986, respectively (see Table 2.4). The second most important partner was the rest of Western Europe, which absorbed 6.5%, 7.4%, and 8.7% of total exports in the same years. The rest of Africa exports to Canada represented 6.1% in 1966 but decreased to 0% in 1986. In that year, the Far East region was the third largest market for the rest of Africa. Exports to that region represented 5.9% in 1966, 4% in 1976, and 4.3% in 1986. During the 1970s, exports from the rest of Africa to the Middle East/North Africa region increased sharply and later decreased.

The Far East includes the Asian continent except for the Middle Eastern countries This region's intraregional trade was more intense than its interregional trade. Its participation in total exports was higher in relative terms with intraregional trade considered (see Table 2.3). The Far East region's share of total world exports was 1.9% in 1966, 2.8% in 1976, and 2.1% in 1986. With intraregional trade not considered, these percentages decreased to .7, 1.5, and .9, respectively. China is one of the countries with the potential to become an important exporter in this particular region and worldwide. Given the level of exports of this region, it occupied position six among the 11 regions considered in 1986

The Far East major partners were Canada and the Middle East/North Africa. In 1966, Canada was the major partner with 56.9% of total Far East exports. In 1986 this percentage decreased to only 25.7. The share of the Middle East/North Africa increased from 40.4% in 1966 to 70.5% in 1986 (see Table 2.4). The United States participation has been increasing slowly through the two decades, passing from 9% in 1966 to 3.5% in 1986. With these exceptions, the rest of the regions were not major partners of the Far East.

Oceania held the seventh place relative to the rest of the regions considered. Table 2.3 shows that, with intraregional trade included, the percentages representing this region's participation in world total exports were .7 in 1966, .2 in 1976, and .9 in 1986. Excluding intraregional trade, these percentages decreased slightly to .4, .2 and 8, respectively. This suggests that Oceania's intraregional trade was relatively more important than its external trade.

In 1966, the major partners of Oceania included the Far East and the EC regions with 65.4% and 24.6% of exports, respectively (see Table 2.4). In 1986, the main partners were the Far East and the Middle East/North Africa regions with 71.4% and 15.4%, respectively. The EC share decreased from 23.9% in 1976 to 5.0% in 1986. Canada's share of Oceania's exports was .4% in 1966, 18 5% in 1976, and 5 9% in 1986. Similarly, the rest of Western Europe sharply increased its participation in the 1970s from 3 1% in 1966 to 21.1% in 1976. In the 1980s, this percentage decreased again to the 1966 level. The rest of Africa was another important partner of Oceania's exports with 2.2% in 1966, .4% in 1976, and 1.5% in 1986.

EC production of oranges is relatively small and mainly concentrated in southern France. Nevertheless, trade data reveal some intraregional trade and a small amount of external trade. Including intraregional trade, world export participation of the region was .9% in 1966, 2.4% in 1976, and 3.6% in 1986 (see Table 2.3). With intraregional trade excluded, these percentages decreased to .1, .2, and .4, respectively. This indicates that the EC region occupied position number eight relative to the rest of the regions with regard to world fresh orange export share in 1986.

The main partner of EC exports is the rest of Western Europe, with 51 5% in 1966, 34.5% in 1976, and 74 2% in 1986 (see Table 2.4). Interestingly, in 1966, 36.8% of the EC's total exports were directed to the rest of Africa and, in 1976, 52.6% were sent to the Middle East/North Africa In both cases, the participation of these regions rapidly decreased to 3.6% and .5%, respectively, in 1986. The rest of the regions were not significant partners to the EC except for the Communist Bloc.

This region's participation was 6.8% in 1966, 4.6% in 1976, and 4.9% in 1986.

The Communist Bloc has been increasing its participation in world total exports from almost zero in 1966 to .6% including intraregional trade and .3% excluding intraregional trade in 1986 (see Table 2.3). With these percentages, the Communist Bloc held position number nine concerning world exports of fresh oranges in 1986.

The Communist Bloc region has two principal partners, the EC and the rest of Western Europe (see Table 2.4). The EC and the rest of Western Europe absorbed 11.2% and 88.8% in 1966, 97.3% and 2.6% in 1976, and 94.1% and 2.1% in 1986, respectively. The rest of the Communist Bloc exports in 1986 went to the Latin America region.

Finally, Canada and rest of Western Europe are not exporters of fresh oranges. Weather conditions in these regions do not allow them to produce oranges (see Table 2.3). However, trade data revealed some exports out of those regions. Most of that trade was related to re-exports reported as exports.

Region Perspective

In this section, the discussion will be based on importers' viewpoint. Once again, the relative importance of each one of the regions will be set forth and then trade flows will be discussed.

As shown in Table 2.3, the leading importer of fresh oranges including intraregional trade was the EC region, with shares of 68.8% in 1966, 54.5% in 1976, and 64.3% in 1986. Considering only interregional

trade, the shares for the same years were 69.9%, 61.3%, and 67.3%. These percentages show that EC trade with other regions was more important than its own within-region trade.

Table 2.5 shows that, in 1966, 47.1% of the total EC imports came from the Mediterranean-EC region, while in 1986 this percentage reached 67.4. The second largest exporter to the EC region was the Middle East/North Africa region with 38.3% in 1966 and 21.2% in 1986. The third largest exporter was the rest of Africa region with 9% in 1966 and 5.4% in 1986. Other important exporters to the EC region included Latin America and the United States. These two regions' EC market shares were 2.9% and 2.4% in 1966, and 5.4% and .3% in 1986, respectively. The major portion of the EC market growth has been captured through the years by the Mediterranean-EC region. Latin America was the only other region whose share of the EC market grew in the last two decades. The rest of the regions' exports to the EC were minimal.

The second largest importer of fresh oranges was the rest of Western Europe with 11.0% in 1966, 8.8% in 1976, and 10.2% in 1986 (see Table 2.3). With only interregional trade used, the percentages increased to 11.3, 10.2, and 11.3 for the same years.

As shown in Table 2.5, the leading exporter to the rest of Western Europe region was the Mediterranean-EC region, with 59.9% in 1966, 40.8% in 1976, and 58.4% in 1986. The second largest exporter to this region was the Middle East/North Africa with 31.7%, 51.5%, and 34.0% for the same years. Another important exporter to the rest of Western Europe was the rest of Africa with 4.4% in 1966, 4.8% in 1976, and 3.3% in 1986. Even though the EC was not a major producer of fresh oranges, it was the fourth

major exporter to the rest of Western Europe region in 1986. Latin America increased its participation in this market passing, from .8% in 1966 to 1.1% in 1986. The United States, once the fourth major exporter to the region, was a very small participant in the rest of Western Europe fresh orange trade. The rest of the regions' exports to the rest of Western Europe were relatively small.

The third largest importer was the Communist Bloc with 9.1% in 1966, 14.3% in 1976, and 8.3% in 1986 (see Table 2.3). With only interregional trade considered, the percentages increased to 9.3, 15.4, and 8.7, respectively.

The major supplier of fresh oranges to the Communist Bloc was the Mediterranean-EC with 52.8% in 1966, 32.1% in 1976, and 57.1% in 1986 (see Table 2.5). The second largest exporter to the region was the Middle East/North Africa with 44.2%, 61.9%, and 39.6%, respectively. The third largest exporter was the Latin America region with 1.3%, 4.4%, and 3.0% in the same years. During the 1970s, the Communist Bloc countries drastically increased their consumption and the deficit was mainly supplied by the Middle East/North Africa region. During the 1980s, consumption went back to the original trend. The United States exported 1.6% of the Communist Bloc's total imports in 1966, and 1.5% in 1976. In 1986, the United States did not export fresh oranges to the Communist Bloc region. The rest of the regions were not very important relative to total Communist Bloc's imports of fresh oranges.

The three principal regions mentioned above have been relatively stable in their participation in the world's fresh orange imports in the

last two decades. As a whole, they represented 90.5% in 1966, 86.9% in 1976, and 87.3% in 1986 of total world imports (see Table 2.3).

The Far East has been consistently growing as an importing region in the last two decades. It passed from 3.4% in 1966 to 4.8% in 1976, and to 7.1% in 1986 (see Table 2.3). With intraregional trade omitted, these percentages decreased to 2.3, 3.8 and 6.4, respectively. This shows that trade among countries belonging to the Far East region was important relative to the rest of the world's trade with the same region.

The United States was the leading exporter to the Far East region in the period considered. Its exports represented 49.5% in 1966, 90.6% in 1976, and 86.2% in 1986 (see Table 2.5). The second exporter to the Far East was Oceania, with 11.5%, 1.9%, and 8.4%, respectively. The third exporter was the rest of Africa. However, its participation has been decreasing, from 19.9% in 1966 to 2.9% in 1986. The fourth exporter to the Far East was the Middle East/North Africa region, whose participation has also decreased from 17.8% in 1966 to 1.8% in 1986. The Mediterranean-EC region represented the fifth exporter to the Far East region, with a consistent participation in the market of only .5%. Latin America's share of the market decreased from .8% in 1966 to .1% in 1986. It is clear from these numbers that the United States was the only exporting region whose market share grew in the Far East.

The Middle East/North Africa region was another significant importer of fresh oranges. Its participation grew from .6% in 1966 to 11.8% in 1976, but decreased later to 5.2% in 1986 (see Table 2.3). The table shows that the percentages excluding intraregional trade were .3 in 1966,

3.0 in 1976, and 1.1 in 1986. Therefore, the principal trade of this region was among the countries constituting the region.

The major exporter to the Middle East/North Africa countries was the Far East region, with 55.7% in 1966, 31.2% in 1976, and 53.8% in 1986 (see Table 2.5). The second principal exporter to this region was the Mediterranean-EC with 9.0% in 1966, 22.8% in 1976, and 29.7% in 1986. The third exporter was Oceania with 5.1% in 1966, 0% in 1976, and 10.3% in 1986 Even though exports from Latin America appear insignificant compared to other exporters to the Middle East/North Africa, they have been growing very rapidly in the last few years, passing from 0% in 1966 to 5.9% in 1986.

Canada was an important importer of fresh oranges. During 1966, its imports represented 5.2% of the world's trade. This percentage decreased to 4.5 in 1976 and 3.4 in 1986 (see Table 2 3). With only interregional trade considered, these percentages increased slightly to 5.3 in 1966 and 1976, and 3.7 in 1986

The major supplier of fresh oranges to Canada was the United States, with 77.8% in 1966, 84.7% in 1976, and 68.0% in 1986 (see Table 2.5). The second largest exporter to Canada was the Middle East/North Africa region, holding 4.7%, 1.4% and 11.8% for these years. The third major exporter was the Far East region with 7.6% in 1966, 10.2% in 1976, and 5.9% in 1986. In the last few years, the Mediterranean-EC region, whose share was insignificant during the 1960s and the 1970s, have increased their participation in this market. In 1986, Mediterranean-EC supplied 10.2% of the Canadian market Latin America increased its share of the market from .8% in 1966 to 2 9% in 1986. Similarly, Oceania increased its

participation in recent years, passing from 0% in the 1960s to 1.2% in 1986. The rest of the regions were not very important with regard to exports to the Canadian region.

The rest of the regions represented small percentages of total imports in the world's fresh orange industry (see Table 2.3). The United States import share was .8% in 1966, .7% in 1976, and .9% in 1986. These percentages changed very little if only interregional trade were considered. Major exporters to the United States were Latin America with 45.2%, Mediterranean-EC with 32.0%, and Middle East/North Africa with 19.7% in 1986. The Mediterranean-EC only had .8% and .6% share of the United States market in 1966 and 1976, respectively, indicating that Mediterranean-EC region's participation in the United States has been growing rapidly in the last decade

The Oceania portion of total world imports was .4% in 1966, .2% in 1976, and .4% in 1986 (see Table 2.3). These percentages switched to 2 each reported year if only interregional trade were included.

The exporter with the major portion of the Oceania region's market was the United States, with 40.4% in 1966, 99.6% in 1976, and 99.9% in 1986 (see Table 2.5). Middle East/North Africa and Latin America regions used to have an important share of the Oceania market, reaching 29.6% and 25.9%, respectively in 1966 These regions lost their portion of the market to the United States in the 1970s. The rest of the regions were not major exporters to Oceania.

The rest of Africa's share of total world imports was .3% in 1966, and .2% in 1976 and 1986 including intraregional trade (see Table 2.3).

If interregional trade were excluded, these percentages changed to .1 for the last two years reported.

The four major suppliers of fresh oranges to the rest of Africa were the Middle East/North Africa with 83.0% in 1966, 71.2% in 1976, and 70.5% in 1986; the EC with 11.8%, 9.3%, and 12.5%, respectively; Oceania with 3.4%, .7%, and 8.9%, respectively; and the Mediterranean-EC with .1%, 14.1% and 8.0%, respectively (see Table 2.5). The United States share of the rest of Africa market was .6% in 1966. However, the United States lost its share totally by 1986.

Latin America's portion of total world imports was .3% in 1966, 4% in 1976, and .1% in 1986 (see Table 2.3). Given that most of its trade was among countries of the region, these percentages decreased to .2 in 1966 and to 0 in 1976 and 1986. Imports in Latin America came from the United States in the 1960s and 1970s (see Table 2.5). In 1986 the United States share was only 68.0% of total imports. The rest of the product came mainly from the Communist Bloc with 33.4%, the EC region with 16.1%, and the Mediterranean-EC with 4.5%.

The Mediterranean-EC region has only a small share of total world's fresh orange imports. Imports reached .2% in 1986 with and without considering intraregional trade (see Table 2.3).

Conclusions

In summary, it is possible to describe most of the world production and trade flows of the fresh orange industry with few regions. On the production side, the major producers of oranges were Latin America, Far

East, United States, Mediterranean-EC, and Middle East/North Africa. Latin America and United States had high percentages of processed utilization. The Far East had an intense within-region trade. Therefore, as shown above, large orange productions did not necessarily imply high participation in interregional fresh orange trade.

On the supply side, the major exporters were the Mediterranean-EC, Middle East/North Africa and United States. However, United States share of total fresh exports was small compared to the other two regions. The Mediterranean-EC region includes Spain, Greece, Italy, and Portugal. The Middle East/North Africa includes the Middle East and the North African countries.

The Middle East/North Africa region has been losing its share of the world market to the Mediterranean-EC in the last few years. It is clear that the leading world exporter was the Mediterranean-EC region. The United States, once a major exporter to the European markets, shifted to the Far East and Oceania markets. United States share declined in most markets, with the exceptions mentioned above. Finally, the Latin America region increased its share of the total market in last two decades.

On the demand side, the major importer was the EC region which includes the EC countries except for Spain, Greece, Italy, and Portugal. The second largest importer was the rest of Western Europe, which represents the rest of the Western European countries. The third largest importer was the Communist Bloc, among which the major importers were the Eastern European countries.

CHAPTER 3
LITERATURE REVIEW

International Agricultural Trade Models

Several models or approaches to study international trade have been developed in the last two decades These models were developed mainly due to the need for knowledge and understanding of increasing world trade Thompson (1981) presented an interesting survey of new developments in international agricultural trade models. In his document, each model was reviewed in three sections: a historical survey, an evaluation, and a summary and implications section. The different modeling approaches were divided into two basic groups determined by the number of regions considered in the model. The two groups were two-region models and multiple-region models of agricultural trade The latter was further divided into three groups: non-spatial price equilibrium, spatial price equilibrium, and trade-flow and market-share models.

A different classification system for international trade models was developed by Thompson and Abborr (1982). Each modeling approach was grouped based on the assumptions made about the homogeneity of the commodity traded. The two major categories identified in their research were single homogeneous commodity models and multiple-product models. The single homogeneous commodity models were divided into three groups: non-spatial price equilibrium, spatial price equilibrium, and two-region

models. The multiple-product trade models were also divided into three groups: general equilibrium (including agricultural and non-agricultural products), multiple related commodity products (including only agricultural products), and differentiated product models (differentiated by place of origin). The two-region and the general equilibrium models were special cases of non-spatial price equilibrium models. Thompson and Abbott's (1982) classification procedure added important insights into the discussion about new developments in international agricultural trade models. The major contribution was their extensive treatment of and emphasis on the characteristics of the products traded and how consumers perceived them.

In the following discussion, Thompson's (1981) approach will be followed. His classification was basically the same as the one presented in Thompson and Abbott's (1982) investigation. The most important difference between the two studies was the emphasis that the latter researchers gave to product differentiation.

The first type of model covered by Thompson (1981) was the two-region model. The model divided all countries of the world into two groups, the country of interest and the rest of the world. This version was basically a domestic agricultural sector model enlarged with exogenously driven exported or imported quantities. Export equations or excess demand equations were developed for the rest of the world. The model included linkages between the domestic and world prices to reflect the simultaneous determination of domestic consumption, supply, and prices with the rest of the world. The models did not take into consideration trade flows (destination) but instead accounted for the net trade between

the country of interest and the rest of the world. They did not provide information on demand and supply for individual foreign regions or on the share of the market that any particular country has in a specific region.

Without knowledge of the structure of supply and demand in each major trading region, it is impossible to say how the excess demand function will change given an exogenous shock or a change in policy. It is then very difficult under the two-region models to evaluate the impact of shocks or policies in a given country. Such models do, however, provide a good framework to analyze domestic farm and trade policies.

According to Thompson (1981), multiple-region world trade models were developed to answer broader questions regarding the impact of exogenous shocks and policy changes for trading regions in the world. They also provide information about the market share of each region by destination. The non-spatial price equilibrium models treat the interrelations among trading regions by assuming that the world market price is determined simultaneously by the demand-supply balance in all trading regions such that the world market clears Solution of the model gives the world market prices and the net trade for each region, but it does not provide any information on source or destination of trade flows.

Multiple-region world trade models allow for the introduction of transportation costs, tariffs and nontariff barriers, and other policy variables through the price linkage equations. These models are for many reasons an improvement over the two-region models, since they endogenously determine the demand and supply in each of the trading regions. However, they usually have an important drawback. The price linkage frequently used is not consistent with the spatial price equilibrium theory. This is

so because in some cases a unique world price is assumed and in other cases a base country or region price is used and linked with the rest of the regions by the transportation cost. The model ignores the fact that some regions may not trade at all with the base region. Solutions to these models are obtained by solving an econometric simultaneous system of equations.

The second type is the spatial price equilibrium models. These models differ from the non-spatial and the two-region models in the fact that they consider endogenous trade flows and market shares. Prices are linked only between those pairs of countries that actually trade with each other. The rest of the characteristics are similar to the ones mentioned for the non-spatial equilibrium models, except for the solution method. They usually follow a quadratic programming procedure for estimation.

None of the models described above can replicate all of the observed trade flows since they are designed to predict trade flows of homogeneous products (Grennes et al., 1977 and 1978; Thompson, 1981; and Thompson and Abbott, 1982). If products are homogeneous, then price differences between regions are given only by transportation costs and trade barriers. Products may not be perfectly homogeneous and may be differentiated by country of origin. Therefore, prices may vary between regions for reasons other than transportation costs and trade barriers.

A serious formulation of a spatial price equilibrium model will be to determine trade flows exclusively by minimizing the transportation cost. According to Grennes et al. (1978) "nearly everyone who has employed spatial models concedes that the world does not behave this way". This situation is intuitively appealing, and indeed there is enough

empirical evidence that this may be the case for wheat (Grennes et al., 1977 and 1978; Thompson, 1981) and other agricultural products. Spatial price equilibrium models have few capabilities except for the weak and incomplete explanation of trade flows given the problems mentioned above.

Trade-flow and market-share models are the third type of multiple-region models considered by Thompson (1981). These models were developed to account for the observed variation in trade flows more adequately than do the spatial equilibrium models.

Taplin (1967) and Johnston (1976) in a partial sense surveyed world trade models concerned primarily with trade flows. They studied the ones that analyzed the structure of world trade and the short-run trade fluctuations among countries. In his paper, Taplin classified them in two categories: the ones that have separate functions for total exports and total imports but do not attempt to estimate the individual flows between countries; and the ones that look at individual flows directly.

In the first part, Taplin's discussion went from an import-export matrix developed by the League's Network of World Trade (1942), passing by Woolley's (1965) transactions matrices on payments for trade, services, and capital flows, to Beckerman's (1956) input-output approach. These studies provided important insight into the structure of the international economy. However, they did not represent a formal model where hypotheses could be tested, measured or forecasted.

The second part of Taplin's investigation continued with a survey covering other studies (Tinbergen, 1962; Linnemann, 1966; Waelbroeck, 1962 and 1965) where individual trade flows (from the import-export matrix) between countries were considered to be a function of income, population,

trade preference, and distance variables. In these models, prices were normally omitted given that cross-section models were used, with data at the same point of time. Prices were assumed not to change. These models did not capture shifts or changes of trade which might develop in the long run because of more complicated interrelationships among prices, income, and imports.

Taplin continued his study by reviewing four different transmission models that tried to establish the main relationships between the level of domestic economic activities in the various countries and their international transactions. The four models surveyed and reported by Taplin were: Metzler (1950) who focused on changes in investment; Neisser and Modigliani (1953) on income and capital flows; Polak (1954) on autonomous investment and price changes; and Rhomberg (1966) and Rhomberg and Boissonneault (1964) who focused on income, prices, and capacity. Rhomberg and Boissonneault (1964) developed a trade-flow and market-share model that considered three regions, the United States, Western Europe, and the rest of the World. An aggregated commodity called merchandise, including all commodities traded among the regions, was defined and used to estimate income and price elasticities.

Taplin concluded that a model was needed that incorporates the type of disaggregation possible with a constant share approach and the flexibility and economic content provided by a transmission model. Taplin also proposed a three stage procedure to accomplish his recommendations: consider the import demand for 10 to 12 regions for six good's classes; determine what share of the import market the other countries have in supplying the given country's imports; the export-supply schedules should

tie into the model. These conclusions provided guidelines for continued research in trade-flow and market-share models during the latter part of the 1960s.

Trade-flow and market-share models are based on the idea that products are differentiated by country of origin. Three alternative solution approaches exist: mechanical procedures that transform trade flow matrices from one year to the next without regard for price; econometric models designed to explain one or more elements of the trade flow matrix (an example is Ward, 1976); and modified spatial equilibrium models that take into account that products are differentiated by country of origin. The latter implies that the elasticity of substitution is less than infinite (examples are Hickman and Lau, 1973; Grennes et al., 1978; Johnson et al., 1979; Sarris, 1983 and 1984; Sparks, 1987; Penson and Babula, 1988; Deardorff and Stern, 1986). None of the examples, except for Sparks and Deardorff and Stern, used a simultaneous equation approach to estimate the world trade model. Hence, the results obtained suffer from simultaneity bias (Maddala, 1977, p. 231-251).

The modified spatial equilibrium model approach has been used to estimate a total import demand equation for each importing region and separate market share equations for each region. This approach rests on the assumption that products have unique characteristics distinguishing them from similar products of other exporters. Most studies mentioned above have proved that consumers view goods of the same kind from different suppliers as imperfect substitutes. This is especially true in agricultural trade, where quality and variety characteristics, national factors, variations in harvest time, and monopolistic competition are

normally present. Therefore, different countries faced different elasticities that may vary when market shares differ (Grennes et al., 1977).

Armington (1969a, 1969b, 1970a, 1970b, 1973) developed the theory for market share demand studies which considered goods differentiated by place or origin. Most market-share demand studies have used this theory because of important variations obtained in price and income elasticities among suppliers in the foreign markets (examples are Sirhan and Johnson, 1970; Ito et al., 1985; Lin et al., 1988). Later, Rhomberg (1970) concluded that a complete demand and supply model for a world trade and payments model could also be developed following Armington's approach

Armington assumed a weakly separable utility function, so that consumers' decision process may be viewed as occurring in two stages (Varian, 1984). Equations can be derived that relate a particular trade flow between two countries to the importing country's index of total imports and a price ratio or relative price. Each region's market share of a commodity may be affected by changes in the size of the market of destination even if relative prices remain unchanged. The price ratio is between the price of the exporting country and an average of the import prices of the same type of product from other origins in the importing country. The total quantity of a commodity to be imported is first determined, and then the quantity is allocated among the competing suppliers

Armington assumed that the total quantity of the product imported is a constant elasticity of substitution (CES) index of the quantities imported from the regions of origin. The assumption was made to simplify

the model and reduce the number of parameters to be estimated, especially when the number of trading regions is large.

Under these assumptions, the cross-price elasticities between all pairs of regions need not be estimated, since they can be obtained from the estimated price elasticities and the estimated "constant" elasticity of substitution (Leamer and Stern, 1970). The CES assumption is highly restrictive. In fact, the model assumes that products are differentiated by country of origin and at the same time assumes that the elasticities of substitution are constant and equal between all pairs of exporting regions in all markets. Arrow et al. (1961) developed the general properties of the CES production function.

Winters (1984) criticized these assumptions on the use of the CES functional form. Winters accepted the initial assumptions of separability among commodities (e.g., food and machinery), while within each commodity group the domestic and foreigner suppliers were treated as non-separable. However, the adoption of the CES made them homothetic and separable over all pairs of sources. Winters concluded that "the separability of domestic and foreign supplies essentially slipped in by the back door,..., rather than as a necessary consequence of two-stage budgeting". Winters' empirical results rejected the assumptions of homotheticity and separability after testing them using the AIDS model (Deaton and Muellbauer, 1980).

Alston et al. (1990) has recently criticized Armington's approach. His research shows that the assumptions of separability and homotheticity with trade data for the cotton and wheat markets were also empirically

rejected using the AIDS model. They also recognized the problems with the AIDS model.

The restrictiveness of the assumptions were recognized earlier by Resnick and Truman (1973). They relaxed several assumptions of Armington's model, especially the one that the elasticities of substitution need to be constant and identical between all pairs of suppliers to each market. They specified a multi-stage decision process instead of Armington's two-stage procedure Again, total imports were determined first and then imports from a sequence of successively smaller geographic regions were determined.

Artus and Rhomberg (1973) also recognized the problem with the assumptions and replaced the CES index function. They used the constant ratios of elasticities of substitution and homogeneous (CRESH) index functions developed by Mukerji (1963) and Hanoch (1971).

Sparks (1987), following Artus and Rhomberg's work, used the constant ratio of elasticity of substitution (CRES) index which makes the model somewhat less restrictive. This assumption implies that the elasticity of substitution for all the products in a market or region i vary by a constant proportion, but the substitutability between products need not be the same. This assumption increases the flexibility of the model but also increases the computational complexity. The model was applied to a highly aggregated commodity (vegetables). In this case, the basic assumption of Armington's model, goods distinguished by place of production, seems less applicable given that the aggregated commodity will be composed of several goods. The model explained that trade flows can

reflect differences due to commodity composition as well as differences due ro country of origin.

Trade-flow and market-share models represent a major improvement over the other models developed to study international trade, since they can more readily depict observed trade flows. The assumption that products are differentiated by country of origin and prices may very between regions for reasons other than transportation costs and trade barriers is intuitively appealing. Furthermore, Armington's simplification by the introduction of an import quantity index function is, in many cases, a necessary condition to operationalize the model and obtain as much information as possible from the trade flows. As will be shown later, the Armington model provides several practical solutions for dealing with a large number of equations and parameters.

Trade Models: The Orange Industry

The fresh orange industry has been studied many times, usually in the context of national markets. A few studies have been developed in the international trade of fresh oranges. In addition, none of the research developed so far considered a complete world trade model for this particular good. Most of the studies have been either partial or descriptive. One of the earliest international trade documents is a descriptive study developed by the U.S. Department of Commerce (1940), which showed citrus world production and trade statistics and trends.

Before the 1950s, little demand estimation for citrus fruits existed. More attention has now been devoted to this economic area by the

Florida Agricultural Experiment Station and by the Florida Department of Citrus (FDOC). As reported by Chapman (1963), the first major step in this area was the work on experimental pricing techniques applied to the orange demand analysis developed by Godwin and Powell during the 1950s. Chapman (1963) and Godwin et al. (1965) developed a study on demand and substitution relationships for California and Florida Indian River and Interior Valencia fresh orange market. Their research was basically concentrated in the U.S. market and focused on questions regarding own-price elasticities and cross-price elasticities between the three regions' in the Grand Rapids, Michigan market.

Dean and Collins (1967, 1968) studied the effects of the European Community (EC) tariff policies in a model of world trade for fresh oranges. Their paper included a summary of world production, consumption, and trade of fresh oranges. Projections of orange production and consumption, estimates of transportation costs, possible future tariffs, and income and price elasticities of demand in the EC for 22 regions were also included. The price elasticities were estimated at the import demand level, i.e., at the location of consumption, but before retail margins were added to the wholesale price. Transportation costs as well as tariffs and any special import taxes were included in determining the wholesale price level. Using a transportation model analysis, the impact of possible future tariff policies in the EC was procured on producer and consumer prices in each of the major countries and on trade flows. Finally, using the results obtained in the different tariff scenarios, the welfare effect on consumers and producers was also captured. The major implication of this document and the ones by Chapman (1963) and Godwin et

al. (1965) is that it is possible to argue that consumers actually see products of the same kind coming from different regions as non-perfect substitutes.

Weisenborn et al. (1970) estimated the price-quantity relationships at the processor or packer FOB level in foodstore, institutional, and export market channels for Florida oranges and orange products. The products included fresh and processed oranges. As reported by Weisenborn et al., virtually no previous demand analysis had been completed for the institutional and export sectors at that time.

Prato (1970) used the concept of separability to separate food from non-food items. Once the demand equation was defined for only food items, he showed that the correlation between first differences in the prices of orange products and first differences in the prices of each of the other food items were not significantly different from zero. Therefore, individual demand equations for fresh and processed oranges without the introduction of other food item prices could be defined. As reported by Prato, research findings appear reasonable when compared with estimates derived using other and more conventional approaches.

Tang (1977) studied the world demand for United States fresh grapefruit in four markets: the United States, Japan, Europe, and Canada. In his research, Tang identified and measured the effects of the different factors that affect domestic and export demand in order to determine the optimal allocation of United States fresh grapefruit to the domestic and export markets. The results were used to simulate the grapefruit industry

to ascertain its performance to changes in the major factors. The system of equations was estimated using a seemingly unrelated regression (SUR) model.

Nelson and Robinson (1978) developed a model to analyze retail and wholesale fresh navel orange demand under marketing order policy. Two important issues were raised in this study: apples and bananas could be used as substitute products for fresh oranges; and the demands for fresh and processed oranges are independent. The first issue was raised previously by Matthews, Womack, and Huang (1974) with encouraging results. Preto (1969) found that demands for fresh oranges and concentrate are independent, at least in the winter season.

Ward (1981) applied time-varying parameters (TVP) to analyze the welfare impact and economic forecast based on a better understanding of the economics of the EC fresh orange industry This study was especially important at that time given the plans of enlargement of the EC to include Greece, Spain and Portugal. To support the use of TVP, Ward argued that, given the evolution of the EC and its related regulations, it is possible to hypothesize that some adjustments in the demand parameters are likely to have occurred over the decades since the early 1960s. He also estimated the model using Ordinary Least Squares (OLS) and the results were compared. It was clear that the use of TVP performed better that the simple OLS estimation technique.

McCabe (1982) estimated a model to determine the characteristics of fresh citrus consumers. The major objective was to ascertain how demographic and household characteristics affect purchase decisions and to determine its relationship with product prices

Wardowski et al. (1986) recently edited a book that includes a descriptive analysis of world production practices and trends and a long-term view of fresh citrus trade An interesting discussion on trade flow and market share of imports and exports was presented. Global trade for the 1980s was projected, based on the assumption that trade will growth one third less rapidly than in the previous decade, given special assumptions for each citrus product. Individual country/region projections were based on historical trends in per capita availability, where such trends were evident or trends on total imports were estimated. The use of trends in projecting import demand was based on the assumption that future levels of economic factors that determine demand will follow historic trends. No demand estimation was pursued to determine trade flow and market share in this study.

Lee and Fairchild (1988) used a SUR technique to study the relationship between exchange rates and foreign demand for United States fresh grapefruit. The results showed that exchange rates played a major role when studying export demand relationships and the United States fresh grapefruit has more than one export market, with markets responding differently to price changes. These results will be used later to define the model to be estimated.

Lee et al. (1990), using the absolute version of the Rotherdam model, studied the Japanese citrus products market. The study used fresh bananas and pineapples as substitutes for fresh citrus products. One of the major conclusions of the study was that United States fresh grapefruit exports compete against imports of bananas and pineapples for Japanese import dollars. In the case of fresh oranges, the results were not

consistent with the expected signs; especially in the case of pineapples, which turned out to be a complement for fresh oranges, an unexplainable result as reported by Lee et al. This article and the one by Nelson and Robinson (1978) have interesting insights that will be considered later in order to define the best substitute products for fresh oranges.

Even though the present study will not deal directly with the processed orange industry, a few comments on the literature reviewed will be made. Friscott (1969) developed a model to estimate the demand for citrus products (juices) in the European market. One of his major findings was that there is substantial substitution among products of specified countries, reinforcing once again the need to differentiate products by place of origin. Weisenborn et al. (1970) used the theory of price discrimination to determine the optimal market allocation of Florida orange production for maximum net returns. To solve the problem of price discrimination, quadratic programming and calculus with LaGrangean multiplier techniques were used. Malick (1980) used a simultaneous equation model of the Florida retail orange-juice marketing system to forecast changes in the FOB price and retail movement of frozen concentrated orange juice (FCOJ). Irias (1981) developed an econometric model to study international trade of FCOJ among three regions, the United States, Brazil, and Europe Margoluis (1982) developed a model to estimate implicit prices for juice and drink characteristics using hedonic price functions. Ting (1982) developed a model to test the existence of asymmetric price response in the irreversible demand functions for citrus juice products.

Most of the work has been concentrated on the United States domestic market analysis and in specific econometric models designed to explain one or more elements of the international trade flow matrix and markets. The studies are usually related to the United States product behavior in Canada, Europe, and Japan. In most cases, the estimation has been pursued using single-equation estimation and, in a few cases, using SUR. The fresh orange industry has not been studied in a full simultaneous spatial equilibrium world trade model modified to take into account that products are differentiated by country of origin and therefore are not perfect substitutes. The results presented in many of the articles and books reviewed regarding trade of different commodities, and specifically fresh and processed oranges, strongly support the conclusion that fresh citrus coming from different countries (or regions) are perceived as different products by consumers The main objective of the present study will be to develop and estimate a modified spatial equilibrium world trade model for the fresh orange industry. The model will be used to analyze the impact of different trade policies and economic factors affecting the demand for fresh orangee in different regions of the world.

CHAPTER 4
WORLD FRESH ORANGE TRADE MODEL

Introduction

With international trade models it is frequently assumed that goods of a given kind supplied by different (national) sellers to a single country are perfect substitutes in the final market. With this assumption, consumers differentiate goods only by kind, and there is no evident difference between products of the same kind supplied from different sellers. It also implies that the elasticities of substitution between suppliers are infinite, and that the corresponding price ratios are constant (Armington, 1969a).

In general, fruits, and in particular fresh oranges, are expected to be differentiated by place of origin. There are several varieties of oranges, and regions have soil and climatic conditions favoring the production of only a few varieties. Production seasons are highly variable among regions and yield products at different times of the year. For example, while the Northern Hemisphere countries harvest their oranges from November to June, the Southern Hemisphere countries harvest their fruit from June through October. In addition, product coming from different regions even at the same time period could be perceived to have distinctive quality features by the final consumer.

Under these circumstances, the theoretical model defined in this section will be based on Armington's model of international trade (Armington, 1969a). As previously mentioned, it is a modified spatial equilibrium model that takes into account the concept that commodities are differentiated not only by kind but by exporting region. Armington distinguished commodities from products. For example, the term commodity refers to a specific good such as fresh oranges, cotton or rice, or an aggregated good such as fruits, meats or vegetables. On the other hand, a product is a commodity exported from one region to another; i.e., fresh oranges coming to France from the U.S. is a different product than fresh oranges coming from Spain to the same country of destination.

The first basic assumption underlying this model is that consumers' utility is weakly separable; therefore, the decision process may be viewed as occurring in two stages. The first decision stage is to determined the total level of consumption for each commodity known as "market demands" This decision is usually based upon commodity prices, income levels, substitute commodity prices, and other relevant economic variables. The second step is to decide where to buy the product; i.e., given that the total consumption level for each commodity has been determined, an allocation among the different suppliers has to be made. These are known as "product demands". The distribution among suppliers is based on the commodity's total market demand and relative product prices.

The second basic assumption in Armington's model is that the quantity index function used to represent quantities imported from the regions of origin is linear and homogeneous. This assumption implies that

each region's market share of a commodity is influenced by changes in the size of that market, even when relative product prices remain unchanged.

In the present study, 11 regions were defined. The regions were selected consistently with the world orange industry and with particular similarities among the countries included in a region. The regions were the United States (US), Canada (CAN), Latin America (LA), Mediterranean-EC (MED-EC), EC, rest of Western Europe (RWE), Middle East/North Africa (ME/NA), rest of Africa (RAF), Far East (FE), Oceania (OCE), and Communist Bloc (COMMB).

In the next section, a complete world fresh orange trade model is specified. Demand and supply sides are included with equilibrium conditions and price linkages set forth.

Fresh Orange Trade Model

Demand Side

The model was based on the two assumptions mentioned above. Two stage budgeting is implied. Marginal rates of substitution between two goods in a commodity group were assumed to be independent of goods in other groups. In the orange industry, the rate at which consumers substitute fresh oranges produced in one country for those produced in another country does not depend on their purchases of other kinds of fruits or other commodities. The first level of the two stage budgeting is the consumers' decision to allocate their total income among the

different commodity groups available in the region. A percentage of that income is allocated to the total market demand for fresh oranges.

In the general case, the utility function for consumers in region i given n commodities is:

(4.1) $U_i = U(X_i)$

where

X_i $= (X_{i11}, X_{i12}, \ldots, X_{i1m}, \ldots\ldots, X_{ni1}, X_{ni2}, \ldots, X_{nim})$ is the total bundle of commodities for region i, and m the total number of regions or countries considered.

The first subscript for X_{kij} represents the commodity (n commodities), the second represents the region of destination (m regions), and the last subscript denotes the region of origin (m regions). Given the assumption of weakly separable utility function or independence among commodities in different groups and following Solow (1955-56) and Armington (1969a), it is possible to write this utility function for region i as follows:

(4.2) $U_i = U'(X_{1i.}, X_{2i.}, \ldots, X_{ni.})$

where

$X_{ki.}$ $= \mu_k\ (X_{ki1}, X_{ki2}, \ldots, X_{kim})$ for k=1,2,...,n.

X_{ki} is the total market demand for commodity k in region i. The dot represents the sum over all j's or regions of origin including the domestic region i. The μ_k represents certain quantity index function of the product demands X_{kij} which represent the demand for commodity k in region i coming from region j where j=1,...,m.

Consumers maximize the utility function (4.2) subject to the budget constraint given by

(4.3) $INC_i = \Sigma_k \Sigma_j (P_{kij} * X_{kij}) = \Sigma_k (P_{ki.} * X_{ki.})$, $k=1,2,\ldots,n$ and $j=1,2,\ldots,m$

where

INC_i is total expenditure (or income) for all commodities in region i,

P_{kij} is the price for commodity k coming from region j in region i (or products price),

P_{ki} is the average price of commodity k in region i for $k=1,2,\ldots,n$,

$\Sigma_k \Sigma_j$ is the sum over all k (commodities) for all j (regions).

The resultant "market demand" equation for commodity k in region i is a function of total income or expenditure, commodity k price, other commodities' prices, and other relevant variables:

(4.4) $X_{ki} = X_{ki} (INC_i, P_{1i.}, P_{2i.}, \ldots, P_{ki.}, \ldots, P_{ni.}, Z_i)$

where

Z_i represents other variables of interest.

An interesting result is that total market demand ($X_{ki.}$) is a function of only the average import price for this commodity group and the average price of substitutes and not of the individual product prices (P_{kij}).

Total market demand is then separated by exporting region in the second level of the two stage budgeting process to obtain the "product demand" equations. In this case, consumers minimize the cost of purchasing X_{ki} (total market demand for commodity k in region i). That is, consumers minimize total expenditure (INC_i), subject to the following constraint:

(4.5) $X_{ki.} = \mu_k (X_{ki1}, X_{ki2}, \ldots, X_{kim})$

to obtain the specific product demands. The function μ_k is assumed to be a linear and homogenous function of the product demands X_{kij} to ensure that P_{ki} is independent of X_{ki} . P_{ki} is only a function of $P_{ki1}, P_{ki2}, \ldots, P_{kim}$. The assumption that the quantity index functions are linear and homogeneous is the second restriction (the first being the assumption of independence) that has been placed on U. The product demands generated under these assumptions are functions of the total market demand level (X_{ki}) and the individual product prices (P_{kij}) and is given by

(4.6) $X_{kij} = X_{kij}(X_{ki.}, P_{ki1}, P_{ki2}, \ldots, P_{kim})$

This relationship clearly states that the allocation of imports among regions of origin depends on total market demand and relative prices of the products in the market.

The total market demand equation for the world's fresh orange trade model in any particular region is defined following the theoretical framework developed above. It is possible to write the market demand equation for fresh oranges as independent of other goods consumed in the same region. The model will be dealing with only one good (fresh oranges) hence the subscript "k" is no longer necessary. Let X_{ij} represent fresh oranges exported from region j to region i.

The market demand equation for fresh oranges is expected to be a function of the average market price, income, population, and the price of substitute products. The average market price should be obtained by taking into consideration the local product price and the price of imports including any tariff or preferential treatment In the case of substitute products, it has been necessary to define what is really a substitute for fresh oranges. Several alternatives were considered, including an

aggregated commodity representing all other fruits, an aggregated commodity representing all other goods, and an aggregated commodity representing bananas and apples. The latter alternative was selected based on the characteristics of consumption for fresh oranges which makes bananas and apples better substitutes than the other aggregated goods. Nelson and Robinson (1978) reported that Matthews, Womack, and Huang (1974) used bananas and apples as substitute products for fresh oranges with encouraging results, even though they were in some cases less significant than the ones obtained using other alternatives. In a recent paper, Lee et al (1990) also used bananas as a substitute product for U.S. citrus in Japan. However, in the latter study pineapples instead of apples were used as the second substitute product.

The general form of the market demand equation for fresh oranges is the following:[1]

(4.7) $X_{i.} = f(P^{-}_{i.}, INC^{+}_{i}, POP^{+}_{i}, PRS^{+}_{i})$

where

- f represents some functional relationship between $X_{i.}$ and the variables on the right hand side,
- $X_{i.}$ is the total market demand for fresh oranges in region i,
- P_{i} is the real average market price of fresh oranges in region i,
- INC_{i} is the real income level in region i,
- POP_{i} is the population level in region i,
- PRS_{i} is the real average market price for the aggregated commodity based on bananas and apples or other measure of substitutes in region i.

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[1]Single letter notation represents endogenous variables while three letters depict exogenous variables. The sign associated with each variable represents the hypothesized behavioral relationship between the exogenous variables and the dependent variable.

The second level of two stage budgeting is to allocate total market demand by supplying region. It requires the definition of a "product demand" equation which represents the demand in region i for fresh oranges coming from region j. The product demand functions consider Armington's demand theory of products differentiated by place of origin. Prices for products in commodity markets other than fresh oranges have no effect except through the size of the markets. The function μ_k in equation 4.5 is assumed to be a linear and homogenous quantity index function of the product demands X_{kij} to ensure that P_{ki} is independent of X_{ki}. The average market price $P_{ki.}$ is a function of $P_{ki1}, P_{ki2}, \ldots, P_{kim}$. Equation 4.6 defined the product demands to be a function of the market size and all product prices. Since P_{ki} is a function of all product prices product demands and market shares can be reduced to depend on relative prices and total market demand or market size. The relative price for each product demand is given by the ratio of the product price to the average fresh orange price in the market. The product demand functions are

(4.8) $X_{ij} = h'(P_{ij}^{-}, P_{i.}^{+}, X_{i.}^{+/-})$

where

- h' represents some functional relationship among variables,
- X_{ij} is the demand in region i for fresh oranges coming from region j,
- P_{ij} is the price in region i for fresh oranges coming from region j.

The actual relationship is given by

(4.9) $X_{ij} = h(P_{ij}/P_{i.}, X_{i.}^{+/-})$

where

- h represents some functional relationship among variables.

Given equations 4.8 and 4.9, it is possible to define each region's market share equation as follows:

(4.10) $S_{ij} = X_{ij}/X_{i.} = z(P_{ij}/P_{i.}^{-}, X_{i.}^{+/-})$

where

z represents some functional relationship among variables,

S_{ij} is the market share of fresh oranges for region j in region i.

<u>Supply Side</u>

Total orange production ($PRD_{.j}$) is defined to include oranges supplied to the fresh market (PRD_{1j}) and oranges utilized for processing into orange juices (PRD_{2j}). The orange industry requires several years to introduce new trees and new supplies in the market and high levels of investment to built a new processing plant. It is reasonable to assume that orange production and its utilization levels do not adjust so fast as to be considered part of a simultaneous demand side decision model of international trade. Therefore, total production and, in particular, fresh orange utilization (PRD_{1j}) is considered exogenous in this model. The general equations representing this condition are the following:

(4.11) $PRD_{1j} = PRD_{.j} - PRD_{2j}$

and

(4.12) $PRD_{2j} = \lambda_j * PRD_{.j}$

where

$PRD_{.j}$ is total orange production in region j,

PRD_{1j} is total fresh orange utilization in region j,

PRD_{2j} is total processed orange utilization in region j,

λ_j is the percentage of total orange production utilized in the processed industry in region j and is assumed to be exogenous.

Export Supply Equations

Exporters will respond to export prices by adjusting their level of exports accordingly. Given changes in total production and fresh utilization, exports will also tend to adjust accordingly.

Export supply equations are consequently assumed to be a function of the average export price from region j (average Free On Board price = $F_{.j}$) and total fresh orange utilization (PRD_{ij}) in the region of origin. The export supply equation for fresh oranges is the following:

(4.13) $X_{.j} = \Sigma_i X_{ij} = v(F^{+}_{.j}, PRD^{+}_{ij})$ for $i \neq j$

where

The summations represent total exports of fresh oranges from region j to all other regions,

v represents some functional relationships between variables,

$F_{.j}$ represents the average export price of fresh oranges from region j to all other regions.

The demand equations for local product will follow from the difference between total fresh utilization (PRD_{ij}) plus the change in inventories (when applicable) and the export supply from region j. Demand for domestically produced product is:

(4.14) $X_{jj} = PRD_{ij} + \Delta\, INV_j - X_{.j}$

Given that fresh oranges can be stored only for short periods of time, it is assumed that inventory levels are zero. Accordingly, the change in inventories will be zero and equation 4.15 will be given by

(4.15) $X_{jj} = PRD_j - X_{.j}$

Again, X_{jj} is the amount of product produced domestically and remains in the same region. Total market demand is $X_{j.}$, where X_{jj} is a subset of $X_{j.}$.

Equilibrium Conditions

The equilibrium conditions required to have a closed model for the fresh orange industry include three basic identities. The total market demand in region i must equal the supply of products to that region

(4.16) $X_{i.} = \Sigma_j X_{ij}$

Total market demand in region j ($X_{j.}$) must equal fresh utilization (FRD_{1j}) plus imports ($\Sigma_{i\ i\neq j} X_{ji}$) minus exports ($\Sigma_{j\ i\neq j} X_{ij}$) as follows:

(4.17) $X_{j.} = FRD_{1j} + \Sigma_{i\ i\neq j} X_{ji} - \Sigma_{j\ i\neq j} X_{ij}$

Finally, total production of oranges must equal the total production used fresh plus the total production used processed

(4.18) $PRD_{.j} = PRD_{1j} + PRD_{2j}$

Price Linkage Equations

Total market and product demand as well as export supply are functions of different but closely related set of prices. Total market demand is a function of the average market price for a particular commodity. This price is associated with the local price and the individual product prices (P_{ij}). Each product demand is a function of its own product price and indirectly a function of the individual product prices (P_{ij}) through the average market price ($P_{i.}$). Export supply is

associated to a similar set of prices through the FOB (Free On Board) export price

In this section, the price linkage equations among regions are presented. In each region there is an export price that corresponds to each region. This price is the FOB export price and will be denoted F_{ij}. Accordingly, the average export price for fresh oranges ($F_{.j}$) from region j to all regions is defined as follows:

$$(4.19)\quad F_{.j} = [\Sigma_{i\ i\neq j}(F_{ij} * X_{ij})] \;/\; [\Sigma_{i\ i\neq j} X_{ij}]$$

The numerator in equations (4.19) represents the total export value from region j to all other regions and the denominator represents the total quantity exported. The use of i≠j is because no data are available for within-region export price (F_{jj}), and the equations represent the weighted average export price, which should not include the local price. Since F_{jj} is not available for all regions and will be used in the following calculations, it will be assumed to equal $F_{.j}$.

The CIF price is the price of a product in the port of final destination. The C_{ij} represent the CIF price of fresh oranges coming from region j to region i. These prices do not include any trade barriers and are a function of the F_{ij} price. Changes in the FOB export prices (F_{ij}) are not expected to have the same impact on the CIF import prices (C_{ij}) across regions. This follows from the assumption that certain market structures could exist and prevent perfect transmission of prices from the regions of origin to the regions of destination. Spoilage or product deterioration during the transportation process from region j to region i could be different than from region r to region l. Therefore, the general relationship between CIF (C_{ij}) and FOB (F_{ij}) prices might not be linear.

In addition, C_{ij} is assumed to be a function of a trend variable to capture technological changes over the years and an energy price index which take into consideration the price of energy over time. The equation for the C_{ij} price is

(4.20) $C_{ij} = q(F_{ij}^{+}, TRD^{+/-}, PEN^{+})$ for $i \neq j$

where

- q represents some functional relationships among variables.
- C_{ij} is the price for fresh oranges in the destination port (region i) coming from region j for $i \neq j$,
- TRD is a trend variable to capture technical improvement (-) or decay (+) over time,
- PEN is the energy price index.

The market price of fresh oranges coming from region j to a destination region i is not given by the C_{ij} price directly. CIF prices should be increased or decreased by the effect of trade barriers or preferential treatments in the final market i. These barriers could be found to be represented by percentages of the import price or absolute value tariffs which have to be added (barrier) or subtracted (preference) to obtain the real final market price. Therefore, the final market price for fresh oranges from region j to region i is given by

(4.21) $P_{ij} = C_{ij} * (1 + TAB_{ij}) + TAX_{ij}$

where

- TAB_{ij} is a percentage that represents the tariffs (positive) or preferential treatment (negative) effects on the C_{ij} price for fresh oranges coming from region j to region i,
- TAX_{ij} is an absolute value term that represents a tariff per unit of product (positive) or a direct preferential treatment (negative) that effects the final price in market i of fresh oranges coming from region j.

Given that TAB_{jj} and TAX_{jj} are zero, P_{jj} will be equal to C_{jj} and thus equal to $F_{.j}$.

The present model will not consider other type of trade barriers. It is not clear from the data whether quotas have been limiting; however, they could have been in some periods within certain years, especially in the case of Japan. Quotas are imposed only in a few countries of the world. In most cases, they are in place just for some months of the year. The fresh orange trade model utilized annual data, so it will not capture seasonal barriers. If quotas are included in the model, inequality restrictions must be required. The empirical estimation of the econometric simultaneous system will be unnecessarily complicated given the presence of the inequality restrictions.

Given the assumptions and conditions set forth above, the average market prices for fresh oranges in region i will be given by

(4.22) $P_i = [\Sigma_j(P_{ij} * X_{ij})] / X_i$

The world fresh orange trade model presented above determines the equilibrium prices, trade flows, fresh utilization, and total demand and export supply for fresh oranges for all regions simultaneously.

CRES Model Restrictions

In the present study, 11 regions representing the world's countries have been specified. Product demand equation (4.9) will be too complicated to be of practical use, given the number of parameters to be estimated. As noted earlier, Armington (1969a) made two important assumptions regarding the substitutability between different products in order to simplify and make the model applicable for empirical analysis. The elasticities of substitution in each market were constant, and the

elasticity of substitution between any two products competing in a market is the same as any other pair of products competing in the same market. Following his assumptions, Armington used a constant elasticity of substitution (CES) index of the quantities imported from the regions of origin.

While Armington argues that product coming from different (national) sellers could be differentiated by place of origin, the adoption of the CES specification implies that the elasticities of substitution are constant and equal between all pairs of exporting regions in each market. The cross-price elasticities between all pairs of regions need not be estimated, since they can be obtained from the price elasticities and the elasticities of substitution (Leamer and Stern, 1970). The approach followed by Artus and Rhomberg (1973) and later by Sparks (1987) is applicable in the world fresh orange trade model developed in this study. Artus and Rhomberg used the constant ratio of elasticity of substitution and homothetic (CRESH) index and Sparks used the constant ratio of elasticity of substitution (CRES) index which makes the model somewhat less restrictive. The CRES assumption implies that, even though elasticities of substitution will vary proportionally to maintain the ratios fixed, they are allowed to be different between any two pairs of products competing in the same market.

Given the general form of the market demand equations for fresh oranges:

(4.23) $X_{i.} = \mu(X_{i1}, X_{i2}, \ldots, X_{im})$

and assuming that μ is a CRES index function, the market demand equation has the following form:

(4.24) $X_{i.} = [\Sigma_j (b_{ij} * X_{ij}^{\alpha_{ij}})]^{(1/\alpha_{i.})}$

It can be shown (see Appendix B) that the product demand equation derived from this total market demand is the following:

(4.25) $X_{ij} = [(\alpha_i / (\alpha_{ij} * b_{ij}))^{(1/(\alpha_{ij}-1))}] * [(P_{ij}/P_{i.})^{(1/(\alpha_{ij}-1))}]$
$\quad * [X_{i.}^{(\alpha_{i.}-1)/(\alpha_{ij}-1)}]$

The market share equation is

(4.26) $S_{ij} = X_{ij}/X_i$
$\quad = [(\alpha_{i.}/(\alpha_{ij} * b_{ij}))^{(1/(\alpha_{ij}-1))}] * [(P_{ij}/P_{i.})^{(1/(\alpha_{ij}-1))}]$
$\quad * [X_{i.}^{(\alpha_{i.}-\alpha_{ij})/(\alpha_{ij}-1)}]$

Based on Henoch (1971), the following terms are defined to obtain a simple relationship that includes the Allen-Uzawa (Allen, 1938; Uzawa, 1962) partial elasticity of substitution:

(4.27) $\omega_{ij} = 1/(1-\alpha_{ij})$ as an identity,

(4.28) $V_{ij} = [P_{ij} * X_{ij}] / [\Sigma_j (P_{ij} * X_{ij})]$ as the value share of fresh oranges coming from region j to region i,

(4.29) $\sigma_{ij} = [\omega_{ii} * \omega_{ij}] / [\Sigma_j (V_{ij} * \omega_{ij})]$ as the partial elasticity of substitution for fresh oranges.

As expected, this elasticity varies only by a constant ratio which is $1/[\Sigma_j (V_{ij} * \omega_{ij})]$.

The remaining equations in the model are not affected by the assumption of the CRES index. Hence, the complete system to be estimated is the following:

[Market Demand]

(4.30) $X_{i.} = [\beta_{0i}] * [P_{i.}^{(\beta_{1i})}] * [INC_i^{(\beta_{2i})}] * [POP_i^{(\beta_{3i})}] * [PRS_i^{(\beta_{4i})}]$

(4.31) $X_{ij} = [\delta_{0ij}] * [(P_{ij}/P_{i.})^{(\delta_{1ij})}] * [(X_i\ )^{(\delta_{2ij})}]$ [Product Demand]

where

$$\delta_{0ij} = (\alpha_{i.}/(\alpha_{ij}*b_{ij}))^{(1/(\alpha_{ij}-1))}$$

$$\delta_{1ij} = 1/(\alpha_{ij}-1) = -\omega_{ij}$$

$$\delta_{2ij} = (\alpha_{i.}-1)/(\alpha_{ij}-1)$$

(4.32) $X_{jj} = PRD_{1j} - X_{.j}$ [Demand for Domestic Product]

(4.33) $PRD_{1j} = PRD_{.j} - PRD_{2j}$ [Fresh Utilization]

and

(4.34) $PRD_{2j} = \lambda_j * PRD_{.j}$ [Processed Utilization]

(4.35) $X_{.j} = [\gamma_{0j}] * [(F_{.j})^{(\gamma_{1j})}] * [(PRD_{1j})^{(\gamma_{2j})}]$ [Export Supply]

(4.36) $X_{i.} = \Sigma_j X_{ij}$ [Equilibrium Condition]

(4.37) $X_{j.} = PRD_{1j} + \Sigma_{i\ i\neq j} X_{ji} - \Sigma_{j\ i\neq j} X_{ij}$ [Equilibrium Condition]

(4.38) $PRD_{.j} = PRD_{1j} + PRD_{2j}$ [Equilibrium Condition]

(4.39) $F_{.j} = [\Sigma_{i\ i\neq j}(F_{ij} * X_{ij})] / [\Sigma_{i\ i\neq j} X_{ij}]$ [FOB Average Export Price]

[CIF import price]

(4.40) $C_{ij} = [\pi_{0ij}] * [(F_{ij})^{(\pi_{1ij})}] * [(TRD)^{(\pi_{2ij})}] * [(PEN)^{(\pi_{3ij})}]$

(4.41) $P_{ij} = C_{ij} * (1 + TAB_{ij}) + TAX_{ij}$ [Market Price]

(4.42) $P_{i.} = [\Sigma_j(P_{ij} * X_{ij})] / X_{i.}$ [Average Market Price]

The model is clearly formed by several identities and behavioral equations. The identities need not be estimated. To estimate the rest of the model, equations (4.30), (4.31), (4.35), and (4.40) can be transformed to linear equations by applying logs to both sides of the equations. The parameters which represent the partial elasticities can be read directly from the estimation with the exception of the intercept.

Ordinary least squares estimated parameters are biased for this simultaneous equation model. Another estimation problem in the model is that, even though it is linear in the parameters, it is intrinsically nonlinear in the variables, given that after transforming equation (4.30) total market demand will be in the log linear form while it appears without the log linear form in equation (4.36). As a consequence, nonlinear two stage least square procedure was used. The specific estimation steps used and results will be given in the next chapter.

Model Implications

Modeling the changes of world trade flows of the orange industry by identifying international trade linkages among the major trading regions and recognizing current and emerging problems in the industry is the major objective of the present study. Estimation of the world trade model described above will generate consistent estimates of the parameters of the market demands, product demands, export supply, and CIF import price equations for the major trading regions in the industry. Analysis of the estimated parameters will provide information to help understand the reasons for changes in market shares and facilitate longer term forecasts and policy analyses.

The parameters of the market demands measure the strength of the influence of the average price of fresh oranges in a given region, as well as the intensity of income and population levels, and substitute commodity prices. Using price elasticities, it is possible to predict responses in the different markets to changes in supply prices. Income and population

elasticities give an idea of possible changes in consumption and trade patterns and substitute product price elasticities give information about the strength of substitution with respect to other commodities. The estimated parameters also yield a measure of the substitutability among products of the same kind coming from different regions in a given region. On the supply side, the parameters measure the strength of the relationship between export supply, the average export price and the total fresh utilization for a particular region. The relationship among the import price (CIF), export price (FOB), the trend, and the energy price index (PEN) between regions was measured.

The system will be used to perform sensitivity analyses over several scenarios. External shocks to the different exogenous variables are used to illustrate the impact on fresh orange trading levels and patterns across regions. Each scenario is described in detail at the appropriate point in Chapter 6.

Trade Data Base

To quantify the fresh orange trade model, considerable international trade information is required, including interregional trade flows and values. Trade data on fresh oranges for all countries in the defined regions was needed. Data were used on trade flows from every country to all the other countries reported in quantities (metric tons) and monetary value (U.S. dollars). With these data, it will be possible to obtain by aggregation total export and import quantities and unit prices for each defined region. The unit export price (FOB) from each region was obtained

by using the total amount of dollars and the total quantities shipped from the region. The CIF prices use the data for the port of destination. The period of study includes annual data from 1966 to 1986.

The data mentioned above were obtained from the United Nations Commodity Trade Statistic Tapes (1987). These data have several problems, ranging from reporting errors to different reporting systems and coding mistakes. Some of the problems found were mixed classifications, missing data, CIF import prices less than their associated FOB export prices, and total reported exports different from total imports in the same year. It took at least four full months and the use of several SAS (1982) data management procedures to get the data into a useable form. When possible, data were validated against other sources such Food and Agriculture Organization (FAO) and International Monetary Fund (IMF) Trade Statistics. However, the UN trade data are the only source available containing the information regarding trade flows among the countries included in the analysis. The Standard International Trade Classification code corresponding to fresh oranges (SITC = 05711) was used.

Using the annual UN trade data has two important drawbacks that should be noted. Intrayear seasonality was not captured, since data are given in annual observations. Quality and varietal differences are not captured, since data are collected for aggregated fresh oranges in each country.

UN trade data quantities are given in metric tons and monetary values in thousands of U.S. dollars. Since unit price information in real terms were needed, regional CPI (Consumer Price Index) were used to deflate the dollar values in each region. The U.S. CPI is an alternative

variable which could have been used as in most international trade models (for example see Sparks, 1987). In those cases, the exchange rates are not explicitly included in the model. They are only implicitly included since all value units are expressed in U.S. dollars. That use implies the assumption of purchasing power parity in all regions. It assumes that the exchange rates in each country will perfectly reflect the differences in inflation rates relative to the United States. Given that in practice that is not true (Dornbusch, 1988; Lessard, 1985), the CPI's were estimated for each region using a procedure suggested by Edwards and Ng (1985) that relates exchange-rate indices with inflation rates for each country. The results for each country were aggregated into the regions using a weighted average based on trade levels. The details of the procedure utilized is included in Appendix G. The raw data required to develop this calculations are the exchange and inflation rates per country obtained from the country section of the IMF International Financial Statistics Supplements (various issues).

Income and population levels by country were needed. The Gross Domestic Product (GDP) in current market prices for each country was used as a proxy for income. These data were obtained from the IMF International Financial Statistics Supplements (various issues) and are expressed in billions of U.S. dollars. Population data by country were obtained from Food and Agriculture Organization (FAO) Production Yearbook (various issues). Income levels and population were aggregated according to the regions defined. The regional CPI's were used to deflate the GDP's.

The total production levels by country were obtained in the FAO Production Yearbook (various issues). Given data limitations, the information used in the first five years of the analysis included tangerine production. However, the percentage of tangerines in total production was not important. The allocation to the fresh and processed markets for all regions was not available in published documents. To obtain the information, various documents were used including United States Department of Agriculture-Foreign Agricultural Service (USDA-FAS) Attaché Citrus Annual Reports and Supplements (various issues), the Horticultural Products Review (various issues), and the Citrus Reference Book (1988, 1990) by the Florida Department of Citrus. Also direct consultation with several governmental offices in Washington was used. It is important to note that the final data developed for orange utilization for this research are not available in any other source in the detail collected. Appendix D shows the final orange utilization data used for estimation. Information regarding inventory levels was not needed, given that orange utilization is treated as exogenous and the study is limited to perishable fresh oranges.

Energy prices (PEN) were obtained from the Commodity Prices' section of the IMF International Financial Statistics Supplements (various issues). Fuel prices used corresponded to crude prices from Saudi Arabia and are expressed in U.S. dollars per barrel.

Since local market prices were not available for all countries substitute product prices for fresh oranges were defined using average unit prices for bananas and apples for each country. Weighted average unit prices were obtained by dividing total import values over total

import quantities. The data were obtained from the FAO Trade Yearbook (various issues) and aggregated for regions.

Trade barriers and preferential treatment data were collected from several sources USDA-FAS Attaché Citrus Annual Reports and Supplements (various issues) often provide a reasonable source for identifying trade barriers including tariffs. Other documents consulted included the USDA-FAS publication on U.S. Import Duties (1973), The Florida Citrus Mutual Report (August 1977), Citrus in Japan (1978), the Bulletin International des Douanes (various issues), U.S. Exports: Harmonized Schedule B. Commodity by Country (various issues), Customs Tariff Schedules of Japan (1980), Serris (1984), Baker and Mori (1985), and the Tariff Schedules of the United States-Annotated (1983, 1984, 1985). Tariff schedules obtained by country were weighted by countries' volume of trade to determine the tariff schedules for each region. Appendix E shows the final tariff data used for estimation.

CHAPTER 5
ECONOMETRIC PROCEDURE AND EMPIRICAL RESULTS

Introduction

This chapter will be divided into two main sections. The first covers the estimation procedure and the associated econometric issues. The second discusses the empirical results and its major implications in terms of the fresh orange trade model developed. A general conclusion is given at the end of the chapter.

Econometric and Estimation Procedure

The fresh orange trade model under study is based on 13 relationships for each one of the 11 regions considered. Nine of those relationships are identities and therefore do not need to be estimated. The rest are behavioral relationships that must be estimated. The equations to be estimated are total market demands, export supplies, product demands, and CIF price linkage equations. Each region has one total market demand equation, one export supply equation, and ten product demand and CIF price linkage equations, one for each partner region. The total number of equations in the model including identities added to 440 and the number of equations to estimate totals 242.

Since some of the endogenous variables appear both in natural and in the logarithmic form in the different equations the system is nonlinear. It is simultaneous because the endogeneous variables are jointly dependent.

A basic assumption of the Ordinary Least Square (OLS) model is that the right-hand side variables are independent of the error term. This implies that the expected value of X (exogenous variable) and μ (error term) is zero. In the case where an endogenous variable appears on the right-hand side, this assumption is no longer valid. If a simultaneous system is estimated using OLS, then the parameters obtained will be inconsistent. Therefore, the model has to be estimated using a simultaneous system estimation technique.

The specific method of estimation partially depends on the identification problem. This means whether numerical estimates of the parameters of the structural equations can be obtained from the estimated reduced form coefficients The reduced form of a model is obtained when the endogenous variables are expressed as functions of all exogenous variables If this can be done, the particular equation is identified. If not, the equation under consideration is not identified or is underidentified. An exactly identified equation implies that unique numerical values of the structural parameters can be obtained. An overidentified equation implies that more than one numerical value can be obtained for some of the parameters. Fisher (1976) and Brown (1983) give a complete description and interpretation of the alternative approaches to the identification problem for linear and nonlinear system models in econometrics.

The rules for identification are the so-called order and rank conditions. Let's say that M is the number of endogenous variables and K the number of exogenous variables in a given model. Additionally, m is the number of endogenous variables and k the number of exogenous variables in a given equation of the same model. The order condition says that, in a model of M simultaneous equations, an equation is identified if it excludes at least M - 1 variables (both endogenous and exogenous) appearing in the model. If it excludes exactly M - 1 variables, the equation is just identified. If it excludes more than M - 1 variables, it is overidentified. The order condition is a necessary but not sufficient condition for identification.

The rank condition is both a necessary and sufficient condition for identification. It says that, given a model containing M equations in M endogenous variables, an equation is identified if and only if at least one nonzero determinant of order (M - 1)*(M - 1) can be constructed. The determinant has to be created from the coefficients of the variables (both endogenous and exogenous) excluded from the equation but included in the other equations of the model.

In the case of the fresh orange industry, the trade model is overidentified. The total number of variables in the model is 871, 310 exogenous variables (K) and 561 endogenous variables (M). There is only one way for the estimated equations to be underidentified given the order condition. This will be the case when an equation includes more than 311 variables in the right-hand side, which is clearly not the case. The rank condition is also satisfied, but details will not be presented here.

If a model is just identified, Indirect Least Squares (ILS) could be used to obtained the structural coefficients from the OLS estimates of the reduced form coefficients. Given that the equations are overidentified, the use of ILS will provide multiple estimates for the parameters in each case. Therefore, it will be necessary to use a system estimation technique that provides only one estimate per parameter.

The method used for estimation was nonlinear two stage least squares (NL2SLS), which is a simultaneous limited information method. The first stage of this technique is to determine a set of instruments to be used instead of the endogenous variables that appear in the right-hand side of the original equations. These instruments should not be correlated with the error term but should be highly correlated with the endogenous variable to be substituted. The use of these instruments will ensure that the parameters obtained are consistent. The traditional method to obtain these instruments is by regressing the endogenous variables on all the exogenous variables included in the system using OLS. The instruments obtained will be the predicted values or estimated mean values of the original endogenous variables conditional upon the fixed exogenous variables. The second stage consists in using the instruments obtained to substitute the endogenous variables appearing in the right-hand side of the original equations. Once the endogenous variables have been substituted, the model can be estimated using OLS.

The NL2SLS method does not take into consideration the correlation among the errors across the equations in the model as full information methods do. Accordingly, the use of NL2SLS is based on the assumption that there is no evidence of the existence of an external factor that

could effect all the equations in the model. Maddala (1971) supports this assumption for large econometric models based on two essential points where conventional methods pose problems. One is when the unrestricted reduced form is not estimable because the number of predetermined variables in the system is larger than the number of observations. The second is when one uses system methods where the covariance matrix of the residuals can not be computed again because of too few degrees of freedom. The fresh orange trade model developed here fits partially Maddala's classification, given that the number of equations to estimate is 242 and the number of observations available is 21.

There are several additional benefits in using NL2SLS over the full information methods in this particular trade model. Specification errors are common in large econometric models, and data problems are also expected, given that the model deals with trade data. If there is any specification error in one of the equations of the model, the use of NL2SLS will prevent the error from effecting the rest of the estimated results. On the other hand, full information methods are sensitive to small changes in specification and/or data (Goldstein and Khan, 1976). Using NL2SLS clearly simplifies the estimation procedure, given that it can be applied to an individual equation without directly taking into consideration any other equation(s) in the system. In addition, full information methods require for practical implementation sharpness of identification of the whole model, otherwise it will interfere with the estimation (Klein, 1969). Finally, research has been inconclusive about the performance of the full information methods when compared to the

limited information methods such as the NL2SLS procedure (Goldfeld and Quandt, 1968).

The statistical justification of the NL2SLS is of the large-sample type, which implies that the estimated standard errors in the second-stage regressions are not completely reliable. Therefore, a rule of thumb is that a parameter with a "t" statistic greater than one can be considered significant (Gujarati, 1988).

The procedure to obtain the instruments consists in regressing the right-hand side endogenous variables on all the exogenous variables in the model. Given that in the trade model presented here the number of exogenous variables is large and the period of study includes only 21 years, there will not be enough degrees of freedom to perform the estimation needed to obtained the instruments.

One way to solve this problem is the use of the principal components approach developed by Kloek and Mennes (1960) and strongly supported later by Amemiya (1966). This procedure is capable of reducing the information to a subset represented by a subspace of the K-dimensional exogenous variable space. Six or less principal components usually contained most of the variation of the exogenous variables included in the model and therefore provided the necessary information to perform the estimation. The subset of principal components is used instead of the exogenous variables to obtain the predicted values of the right-hand side endogenous variables or instruments. This procedure has been widely used with good results. A few examples are Jones and Ward (1989), Klein (1969), and Fisher (1965).

In certain cases, it is not necessary and is even better not to use all the exogenous variables of the model to obtain the principal components (Amemiya, 1966). The researcher may wish to remove from the set of exogenous variables those that are not clearly exogenous or those which contribute little to the explanation of the endogenous variables. For the fresh orange trade model, a subset represented by the exogenous variables that clearly contribute to explain the variations of the endogenous variables was included in the first stage. The principal component procedure and final estimation as well as the list of variables included are shown in Appendix F.

The specific relationship between the endogenous variables and the principal components selected for the first stage of the NL2SLS procedure depends on the problem on hand. Previous research has shown that in a model in which nonlinearities in the variables appear, the specification should be also nonlinear (Goldfeld and Quandt, 1972).

In the first stage of the NL2SLS procedure, it is possible to use different functional forms for each relationship among endogenous variables and selected principal components (Johnston, 1984; Goldfeld and Quandt, 1968; Kloek and Mennes, 1960). The use of different specifications gives the model the necessary flexibility to obtain the best results from the first and second stages. In other words, any alternative nonlinear specification use will provide consistent estimates.

Two nonlinear specifications were used. The first one follows a second-degree polynomial which is considered a good approximation following Goldfeld and Quandt's (1972) findings. The second specification follows the Gompertz equation, which is another nonlinear function that

produces an S curve that starts from a lower asymptote and rises to a higher one. Kotler (1971) reports a detailed theoretical discussion on the Gompertz function. Ward and Forker (1990) recently used the Gompertz function in a similar application with good results in the beef industry. The polynomial and Gompertz specifications were used to obtained the first stage of the different equations. The final decision about the type of functional form use was based on the performance of the different equations in the second stage.

To make the method work, it will be necessary to make another important decision. That is to determine the functional form of the endogenous variables to be used as dependent variables in the first stage of the NL2SLS procedure. For the linear case the problem does not arise since variables are the same in every section of the model. When dealing with a model that includes nonlinearities in the variables, at least two different alternatives should be considered.

Suppose that y is an endogenous variable that appears as "y" and as the "logarithm of y" in two different equations of the model. If the "logarithm of y" appears in the right-hand side of one of the equations of the model, two alternatives are possible. First, use the nonlinear form as a dependent variable in the first stage, i.e., log y. This implies one obtains the predicted value of the "logarithm of y" as an instrument for the second stage. Second, use the linear form of y, i.e., y. This implies one obtains the predicted value of y and uses as an instrument the logarithm of the predicted value of y. The second alternative does not follow the rationale of NL2SLS, given that what is needed is the predicted value of the actual variable appearing in the right-hand side of the

equation. It is also known that the expectation of a function is generally unequal to the function of the expectation. Therefore, the second alternative is inappropriate (Goldfeld and Quandt, 1968; Goldfeld and Quandt, 1972). The first method was used to obtain the necessary instruments for the second stage.

The methodology utilized to estimate the model closely follows the nonlinear two stage least squares method proposed by Kelejian (1971) and supported later by Goldfeld and Quandt (1972) and Amemiya (1974). However, the final procedure used introduced different specifications for the equations in the first stage.

Time Series Processor (TSP) International PC Version (TSP User's Guide and Reference Manual, 1983) procedures were used to estimate the model. The final program used for the estimation of the model is included in Appendix G.

The data used cover from 1966 to 1986 and have been recorded from many sources as described in Chapter 4. Trade data were insufficient in terms of degrees of freedom to perform an adequate estimation for some equations. In those cases, a special TSP procedure was utilized to select and estimate only those equations for which trade took place. Equations with less than six trade observations did not provide enough information for a reliable estimation. In that event, the equation was not estimated and its parameters were set to zero. Data were read in from Lotus files.

Empirical Results and Implications

This section of the chapter will discuss the empirical results obtained from the estimation of the fresh orange trade model. The section will be divided into four parts. The first part will show the empirical results for each estimated equation. The second part will present figures showing the actual and fitted values of some of the model's most important equations. The third part will include statistics to evaluate the model's performance in terms of fit, specification, and simulation ability. The fourth part will present a discussion about the parameters obtained. Theoretical economic expectations about signs and magnitudes as well as the implications of the associated "t" statistics will be addressed. The connection of the different findings regarding trade patterns described in Chapter 2 will be addressed throughout the discussion.

Empirical Results

Tables 5.1 to 5.24 show the empirical results of the estimation of the four behavioral equations -- total market demands, export supplies, product demands, and CIF price linkage equations -- for the 11 regions. Tables 5.1 and 5.2 present the results for total market demand and export supply equations. The regions are United States (US), Canada (CAN), Latin America (LA), Mediterranean-EC (MED-EC), EC, rest of Western Europe (RWE), Middle East/North Africa (ME/NA), rest of Africa (RAF), Far East (FE), Oceania (Oceania), and the Communist Bloc (COMMB).

Table 5.1 Total Market Demand Equations

Region		Intercept (+/-)	Market Price (-)	Real GDP (+)	Population (+)	Subs. Product Price (+)	#OBS	#RSQ	#DW	#FST	UTHEIL	21 Years Average % of Total World Demand	Imports
US	PARAM VALUE	-10.000	-1.102	-0 000	2.110	0.040	21	0 11	2 02	13 10	0 026400	1 111	1 200
	STD ERROR	1 330	0 310	0 008	0 111	0 105							
	t STATISTIC	-1.800	-1.000	-1 352	2.100	3.036							
CAN	PARAM VALUE	20 011	-0 008	0 093	-1.102	0.030	21	0.13	1 00	1.32	0.000330	0 101	0 008
	STD ERROR	10 803	0 053	0 300	1 201	0 320							
	t STATISTIC	2 300	-1 200	1 108	-1 000	0 111							
LA	PARAM VALUE	1 301	-0 051	0 001	1 000	0 130	21	0 18	1 03	10 22	0.001900	20 000	0.000
	STD ERROR	1.010	0 310	0 210	5 000	0.200							
	t STATISTIC	0.105	-0.151	0 001	3.110	0.530							
MED-EC	PARAM VALUE	-00 000	-3 101	-0 001	1.110	-0.200	21	0 31	0 21	2 30	0 080032	10.301	0 080
	STD ERROR	50.100	0.102	0 000	0.800	0.010							
	t STATISTIC	-1.200	-1.000	-0 100	1 002	-0.021							
EC	PARAM VALUE	110 210	-1 102	0 810	-0 110	0 200	21	0 00	2 52	0 30	0 031020	8.010	63 021
	STD ERROR	00 801	3 303	8 000	0 218	0 303							
	t STATISTIC	1.000	-0 205	1 200	-1 720	0 000							
RWE	PARAM VALUE	11 802	-1 010	-0 010	-0 711	0.120	21	0 00	1 13	2 01	0 333062	1 631	10 012
	STD ERROR	21.812	0.000	0 202	3.800	0.280							
	t STATISTIC	0.801	-1.033	-0 030	-0.300	0.032							
ME/NA	PARAM VALUE	10 082	-1.130	0 011	-0.000	-0.016	21	0 05	1 80	00 81	0 001027	11 001	1 800
	STD ERROR	8 101	0 101	0 157	0 800	0 200							
	t STATISTIC	2 228	-1 083	2 026	-0 802	-1.843							
RAP	PARAM VALUE	0 600	-0 250	-0 002	0 063	0.081	21	0 21	1 21	1 06	0 301001	2.056	0 164
	STD ERROR	0 380	0 000	0.100	0 001	0.200							
	t STATISTIC	1 000	-0 210	-0 018	1 205	0.300							
FE	PARAM VALUE	-0 321	0 101	0 151	1 000	-0 105	21	0 00	2 00	10 00	0 823110	23.010	0 200
	STD ERROR	3 888	0 000	0.101	0 001	0.013							
	t STATISTIC	-0.113	2 000	0.108	2 000	-2.202							
OCE	PARAM. VALUE	13.000	-1 850	-0.330	-0 021	0.102	21	0 00	1 00	2 20	0 002803	0 004	0.232
	STD ERROR	1 606	0 001	0 000	0 050	0 112							
	t STATISTIC	1 108	-2 800	-0 021	-0 001	1.001							
COMMD	PARAM. VALUE	-0.130	-1 210	1 170	0 005	-0 533	21	0 08	1.03	23 30	0 000000	3 010	10.052
	STD ERROR	04.200	0 053	0 553	3 001	0 500							
	t STATISTIC	-0.003	-2 191	2.127	0 131	-1.000							
										Total		100.000	100.000

Table 5.2 Export Supply Equations

Region		Intercept (+/-)	FOB Price (+)	Fresh Production (+)	@OBS	@RSQ	@DW	@FST	UTHEIL	21 Years Average % of Total World Exports
US	PARAM VALUE	-3.508	-1.979	0.018	21	0.20	1.71	2.19	0.108359	0.095
	STD ERROR	7.007	1.002	0.001						
	t STATISTIC	-0.855	-1.010	1.862						
CAN	PARAM VALUE	8.838	2.285	1.000	21	0.26	2.08	3.40	0.039855	0.004
	STD ERROR	1.758	0.000	0.000						
	t STATISTIC	5.038	2.082	0.000						
LA	PARAM VALUE	1.818	-0.155	0.538	21	0.17	1.85	1.88	0.13531	3.018
	STD ERROR	5.935	0.825	0.340						
	t STATISTIC	0.230	-0.308	1.870						
MED-EC	PARAM VALUE	8.858	-0.009	0.089	21	0.31	2.89	8.02	0.079382	83.896
	STD ERROR	3.008	0.303	0.238						
	t STATISTIC	1.171	-0.031	2.755						
EC	PARAM VALUE	1.825	-0.275	0.092	21	0.82	1.81	81.30	0.172107	0.248
	STD ERROR	0.087	1.870	0.200						
	t STATISTIC	2.155	-0.187	2.388						
RWE	PARAM VALUE	1.003	-2.050	1.000	21	0.49	1.28	0.75	0.355827	0.052
	STD ERROR	1.320	0.038	0.000						
	t STATISTIC	1.283	-8.182	0.000						
ME/NA	PARAM VALUE	-0.083	1.828	1.187	21	0.83	1.11	0.72	0.050222	38.053
	STD ERROR	5.758	0.825	0.838						
	t STATISTIC	-0.115	3.317	2.704						
RAF	PARAM VALUE	7.157	-0.181	0.357	21	0.06	0.55	0.53	0.077803	0.282
	STD ERROR	5.007	0.711	0.350						
	t STATISTIC	1.808	-0.208	1.002						
FE	PARAM VALUE	5.870	-1.288	0.158	21	0.87	1.30	17.88	0.100002	1.080
	STD ERROR	8.785	0.285	8.553						
	t STATISTIC	0.871	-3.802	0.258						
OCE	PARAM VALUE	1.823	-2.201	0.303	21	0.33	0.78	4.51	0.165502	0.479
	STD ERROR	10.532	0.081	0.821						
	t STATISTIC	0.173	-2.802	0.328						
COMMB	PARAM VALUE	-23.268	-1.782	2.188	21	0.05	1.52	51.55	0.105201	0.123
	STD ERROR	3.708	1.828	0.220						
	t STATISTIC	-0.101	-1.258	0.730						
								Total		100.000

Table 5.4 Canada Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	#OBS	@RSQ	@DW	@FST	UTHEIL	21 Year Average % Total Imports	21 Year Average % Total Market Demand
US	PARAM VALUE	-4 222	-0 567	1 371	21	0.38 1.08		3 80	0 857684	78 874	78 874
	STD ERROR	13.580	1.187	1 111							
	t STATISTIC	-0 771	-0.474	1 217							
LA	PARAM VALUE	272 670	-0 470	-18 571	21	0 33	1 15	4 38	0 383205	1 170	1 230
	STD ERROR	90 774	1.835	7 440							
	t STATISTIC	1 563	-0 280	-1 400							
MED-EC	PARAM VALUE	293 408	3 087	-33 710	11	0.32	1.08	4.30	0 785848	1 078	1.078
	STD ERROR	117.070	1.710	10 477							
	t STATISTIC	1.700	1.317	-1 200							
EC	PARAM VALUE	-177.786	-7.864	17 270	9	0 35	0 67	1 00	0 2838	0.010	0 010
	STD ERROR	105 150	0 801	8 071							
	t STATISTIC	-1.500	-1.777	1 731							
RWE	PARAM.VALUE				0					0.000	0 000
	STD ERROR										
	t STATISTIC										
ME/NA	PARAM VALUE	84 112	-0 107	-8 731	11	0 12	0 67	1 21	0 186132	7 480	3 400
	STD ERROR	45 881	0 085	3 728							
	t STATISTIC	1 410	-0 288	-1 215							
RAP	PARAM.VALUE	70.871	0 386	-7 031	12	0.48	3.71	7.87	0 086752	7 444	3.448
	STD ERROR	76 161	0 771	2 865							
	t STATISTIC	1 044	0 474	-1 884							
FE	PARAM VALUE	-18 786	-0 024	7 187	11	0 58	1.74	8 00	0 084044	8 300	8 700
	STD ERROR	8 581	0.359	0 703							
	t STATISTIC	-2 004	-1.771	4.017							
OCE	PARAM VALUE	-108 840	-2 548	14 313	11	0.71	0 07	6 00	0.110378	[illegible]	0.[illegible]
	STD ERROR	47 128	1 164	3.074							
	t STATISTIC	-7 783	-2.014	3.740							
COMMS	PARAM.VALUE				1					0 003	0.002
	STD ERROR										
	t STATISTIC										
								Total		100.000	100.000

Table 5.3 United States Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	@OBS	@RSQ	@DW	@FSI	UTHEIL	21 Year % Total Imports	Average % Total Market Demand
CAN	PARAM VALUE	71 807	1.430	-1.007	11	0 17	1.41	1.04	0.10015	0.031	0 001
	STD.ERROR	84 488	1 118	1 080							
	t STATISTIC	0.888	1 285	-0 888							
LA	PARAM VALUE	-30 037	1 011	3 200	11	0 31	1 58	4 05	0 107023	83 010	2 194
	STD.ERROR	40.060	0.278	2.785							
	t STATISTIC	-0.014	2.840	1.104							
MED-EC	PARAM VALUE	-288 188	-0 817	27 311	21	0 28	1 03	3.48	0.70272	2 780	0 072
	STD.ERROR	111 100	1.473	10.020							
	t STATISTIC	-2 111	-0 582	1.170							
EC	PARAM VALUE	-7 701	-1.114	0.811	10	0 44	1 17	0 20	0 111005	0 030	0 001
	STD.ERROR	00 818	0.384	4 770							
	t STATISTIC	-0.111	-3.234	0.171							
RWE	PARAM VALUE				0					0 000	0 000
	STD.ERROR										
	t STATISTIC										
ME/NA	PARAM VALUE	-116 400	-1 104	11 082	21	0 42	1.00	0.77	0 105217	11.701	0 307
	STD.ERROR	104 010	1.007	7.240							
	t STATISTIC	-1 117	-3.404	1 013							
RAF	PARAM VALUE				1					0 040	0.001
	STD ERROR										
	t STATISTIC										
FE	PARAM VALUE	-0 201	7 110	0 170	11	0.14	1 10	10 70	0 170307	1 071	0 044
	STD ERROR	14 087	1 763	1 002							
	t STATISTIC	-0 588	4 281	0 177							
OCE	PARAM VALUE	-427 828	-1 112	10 060	10	0.75	0 78	10.41	0.288411	0 104	0.002
	STD ERROR	111.020	0.720	0 401							
	t STATISTIC	-1 307	-1 081	1 133							
COMMB	PARAM VALUE				0					0.000	0.000
	STD ERROR										
	t STATISTIC										
								Total		100.000	1.624

Table 5.5 Latin America Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	#OBS	#RSQ	#DW	#FST	UTHEIL	21 Year Average % Total Imports	21 Year Average % Total Market Demand
US	PARAM VALUE	22.120	1.023	-1.000	21	0.21	0.75	3.41	0.273535	80.135	0.031
	STD ERROR	11.172	1.093	0.711							
	t STATISTIC	1.980	1.130	-1.480							
CAN	PARAM VALUE	-4.856	-3.101	0.034	7	0.40	0.00	1.01	0.417101	0.344	0.000
	STD ERROR	45.000	1.170	3.734							
	t STATISTIC	-0.113	-1.855	0.250							
MED-EC	PARAM VALUE	-75.104	-3.047	3.000	8	0.00	1.01	0.03	0.405104	0.700	0.000
	STD ERROR	50.510	3.013	3.350							
	t STATISTIC	-1.060	-0.703	3.258							
EC	PARAM VALUE	-18.003	-0.108	1.400	31	0.13	1.01	1.10	0.352005	3.700	0.002
	STD ERROR	23.364	1.360	1.307							
	t STATISTIC	-0.781	-0.077	1.057							
RWE	PARAM VALUE				1					0.841	0.000
	STD ERROR										
	t STATISTIC										
ME/NA	PARAM VALUE	50.881	-3.080	-3.701	11	0.14	1.61	0.65	0.700545	3.173	0.001
	STD ERROR	80.453	3.733	4.522							
	t STATISTIC	0.733	-1.003	-0.840							
RAF	PARAM VALUE				4					0.080	0.008
	STD ERROR										
	t STATISTIC										
PE	PARAM VALUE				0					8.262	0.000
	STD ERROR										
	t STATISTIC										
OCE	PARAM VALUE				2					0.060	0.000
	STD ERROR										
	t STATISTIC										
COMB	PARAM VALUE	-315.050	1.015	13.015	8	0.31	0.28	3.00	0.470401	2.305	0.001
	STD ERROR	80.070	4.521	6.100							
	t STATISTIC	-2.500	0.378	2.228							
								Total		100.000	0.035

Table 5 6 Mediterranean-EC Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	@OBS	@RSQ	@DW	@FSL	UTHEIL	21 Year Average % Total Imports	21 Year Average % Total Market Demand
US	PARAM VALUE				5					[illegible] 085	0 [illegible]00
	STD ERROR										
	t STATISTIC										
CAN	PARAM VALUE				0					0 000	0 000
	STD.ERROR										
	t STATISTIC										
LA	PARAM VALUE	-117 140	1.777	0 218	10	0 27	1.07	1.28	0.738228	22 012	0.022
	STD ERROR	113 [illegible]0	4.4[illegible]3	7 737							
	t STATISTIC	-1 028	0.387	1 082							
EC	PARAM VALUE	-155 088	-4.717	11.148	15	0 82	2.25	27 81	0.287841	47 784	0.048
	STD.ERROR	48.751	1.020	3 328							
	t STATISTIC	-3.115	-4.625	3 348							
NWE	PARAM VALUE	-185 818	-0 771	12 [illegible]05	12	0 70	1 10	14.53	0.354888	1 747	0.002
	STD ERROR	35.174	0.848	2 378							
	t STATISTIC	-5.283	-1.183	5.388							
ME/NA	PARAM VALUE	-28 011	-0 [illegible]	2 385	10	0 10	1 [illegible]	0 73	0 451283	17 [illegible]	0 [illegible]
	STD ERROR	44.478	0.851	3 003							
	t STATISTIC	-0 852	-1.022	0 788							
RAF	PARAM.VALUE				5					0 073	0 010
	STD ERROR										
	t STATISTIC										
FE	PARAM VALUE				2					0 318	0 000
	STD ERROR										
	t STATISTIC										
OCE	PARAM.VALUE				1					0.042	0 000
	STD ERROR										
	t STATISTIC										
COMMB	PARAM.VALUE				3					0.372	0.000
	STD ERROR										
	t STATISTIC										
								Total		100 000	0 100

Table 5.7 EC Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	@OB2	@RSQ	@DW	@FS1	UTHEIL	21 Year Average 1 Total Imports	% Total Market Demand
US	PARAM VALUE	70 234	-4 886	-3 830	21	0.28	2.02	2.12	0.279022	1.821	1.812
	STD ERROR	47 110	1 284	2 101							
	t STATISTIC	1.401	-3 072	-1 224							
CAN	PARAM VALUE	60 184	-1 010	-2 056	14	0 44	1 34	0 25	0.720700	0 002	8 002
	STD.ERROR	114 070	2 822	7 770							
	t STATISTIC	0.225	-0.272	-0 400							
LA	PARAM VALUE	-27 424	0.180	2 025	21	0.10	0.74	2.10	0.100170	3.270	2.262
	STD ERROR	10 027	0.806	1 321							
	t STATISTIC	-1 200	0.282	1.072							
MED-EC	PARAM VALUE	-12 004	0.722	1.040	21	0 42	1 42	0 01	0.072882	24 192	53 055
	STD ERROR	0 122	1.101	0 020							
	t STATISTIC	-1 431	0.024	2 074							
RWE	PARAM VALUE	02 332	-2.261	-2.020	21	0 23	1 44	2 00	0 251120	0 020	0 020
	STD ERROR	41 204	1 084	2.774							
	t STATISTIC	2 245	-2 042	-2 101							
ME/NA	PARAM VALUE	11 020	1 860	0.144	21	0 27	0 26	3.30	0 002822	32.000	22 248
	STD ERROR	0 240	0.703	0.282							
	t STATISTIC	1.201	2.207	0.247							
RAF	PARAM VALUE	12.030	-0.712	-0.042	21	0 10	0 27	0 02	0 070082	7 001	7 020
	STD ERROR	0 000	0 537	0.010							
	t STATISTIC	1 420	-1 326	-0 004							
FE	PARAM VALUE	-243.120	4.102	23.201	21	0.12	1 00	1.01	0 020020	0 007	0 847
	STD ERROR	103 120	2 517	13 014							
	t STATISTIC	-1.772	1 831	1.702							
OCE	PARAM VALUE	-121 040	5 082	10 071	21	0 27	2.40	3.20	0 260761	0.100	0.100
	STD ERROR	02.227	2 760	4.410							
	t STATISTIC	-2.310	1 020	2.420							
COMMB	PARAM VALUE	-183.600	-0 158	12.080	20	0.27	0.71	11.08	0 04278	0.101	0 180
	STD ERROR	80.000	2 210	2.882							
	t STATISTIC	-2.110	-2 020	2 101							
								Total		100 000	99 560

Table 5.8 Rest of Western Europe Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	#OBS	#RSQ	#DW	#FST	UTHEIL	21 Year Average % Total Imports	21 Year Average % Total Market Demand
US	PARAM VALUE	131 210	-0 010	-10 830	21	0 35	2 30	4 44	0 248230	0 041	0 041
	STD ERROR	53 182	3 233	4.182							
	t STATISTIC	2 014	-2 721	-2 043							
CAN	PARAM VALUE				0					0.000	0.000
	STD ERROR										
	t STATISTIC										
LA	PARAM VALUE	-1 248	-0 835	1 208	21	0.13	1 28	1 38	0 143388	1.022	1.022
	STD ERROR	14 230	0 315	1.100							
	t STATISTIC	-0 300	-1 214	1 001							
MED-EC	PARAM VALUE	-0 743	-2.700	1.012	21	0.28	1 24	3.41	0 088744	45.412	45.412
	STD ERROR	10 030	1 001	0 110							
	t STATISTIC	-0 017	-2 544	2 018							
EC	PARAM VALUE	-24 345	-2 834	2 660	21	0 83	2 03	30 01	0 160080	1 501	1 507
	STD ERROR	14 087	0.335	1.004							
	t STATISTIC	-1.141	-1.074	2.434							
ME/NA	PARAM VALUE	0 311	-2.088	0.212	21	0.13	1.33	23.03	0 047331	47.341	47.341
	STD ERROR	3.033	0 304	0 431							
	t STATISTIC	1 032	-3 288	0 488							
RAF	PARAM.VALUE	-0.171	0 622	0 182	21	0 13	1.22	1 33	0 002121	3 321	3.321
	STD ERROR	0.473	0 513	0 494							
	t STATISTIC	-0 021	1.212	1 302							
FE	PARAM VALUE	38.101	-0 154	-4 750	11	0.01	2 32	0 70	0 140102	0 030	0 030
	STD ERROR	128 330	1.027	0 033							
	t STATISTIC	0.430	-0.413	-0 411							
OCE	PARAM VALUE	-87 413	1 782	7 438	21	0 28	0 08	3 31	0 330171	0 103	0 103
	STD.ERROR	42.110	1.101	3 200							
	t STATISTIC	-2.142	1.310	2 282							
COMMB	PARAM VALUE	37 834	3 388	-1 072	10	0 42	1 98	3.30	0.280077	0 040	0 040
	STD.ERROR	33.010	1 002	2 015							
	t STATISTIC	0.100	5.203	-0 840							
								Total		100.000	100.000

Table 5.9 Middle East/North Africa Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	#OBS	#RSQ	#DW	#FST	UTHEIL	21 Year Average % Total Imports	21 Year Average % Total Market Demand
US	PARAM VALUE	-10.023	-2.203	1.331	10	0.34	1.20	3.03	0.815418	1.403	0.033
	STD ERROR	20.110	1.331	1.000							
	t STATISTIC	-0.330	-1.113	0.010							
CAN	PARAM.VALUE				0					0.000	0.000
	STD ERROR										
	t STATISTIC										
LA	PARAM VALUE	-03.411	1.001	0.140	13	0.20	2.03	2.03	0.438428	14.020	0.334
	STD ERROR	31.540	2.541	3.823							
	t STATISTIC	-1.823	8.111	1.784							
MED-EC	PARAM.VALUE	-47.013	0.202	3.033	10	0.32	1.11	3.00	0.010001	8.311	0.181
	STD ERROR	22.811	1.152	1.483							
	t STATISTIC	-2.130	8.115	2.440							
EC	PARAM VALUE	-30.018	-2.826	2.378	18	0.48	2.10	8.03	0.002988	1.122	0.023
	STD.ERROR	10.524	0.944	1.243							
	t STATISTIC	-1.004	-2.984	2.012							
RWE	PARAM VALUE	-40.630	-0.831	3.300	11	0.24	1.40	1.24	0.31101	1.040	0.041
	STD ERROR	30.362	1.450	2.453							
	t STATISTIC	-1.273	-0.301	1.400							
RAF	PARAM VALUE	-13.883	-1.071	3.803	17	0.80	0.72	10.30	0.330634	20.401	0.037
	STD.ERROR	10.740	3.000	1.300							
	t STATISTIC	-3.141	-0.200	4.030							
FE	PARAM VALUE	-38.437	-0.070	5.204	21	0.37	0.82	11.03	0.303240	30.414	0.063
	STD.ERROR	12.263	0.400	0.824							
	t STATISTIC	-3.210	-1.431	5.900							
OCE	PARAM VALUE	-02.358	-1.430	4.743	20	0.77	1.41	27.01	0.350300	4.230	0.093
	STD.ERROR	10.010	0.110	0.110							
	t STATISTIC	-3.030	-1.003	0.010							
COMMB	PARAM VALUE	-110.410	-3.102	0.263	1	0.64	1.43	3.33	0.394111	0.034	0.001
	STD ERROR	80.034	1.413	5.378							
	t STATISTIC	-1.481	-2.818	1.537							
								Total		100.000	2.231

Table 5.10 Rest of Africa Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	@OBS	@RSQ	@DW	@FST	UTHEIL	21 Year Average % Total Imports	21 Year Average % Total Market Demand
US	PARAM VALUE	11.498	-1 [illegible]	-3.544	17	0.2[illegible]	[illegible].75	1.75	0.444833	0.103	0.002
	STD ERROR	37.909	0.009	2.701							
	t STATISTIC	1.350	-1.031	-1.261							
CAN	PARAM.VALUE				0					0.000	0.000
	STD ERROR										
	t STATISTIC										
LA	PARAM VALUE	3.924	-3.069	0.101	11	0.09	1.05	17.00	0.440043	1.000	0.001
	STD ERROR	38.123	0.920	2.711							
	t STATISTIC	0.101	-3.033	0.037							
MED-EC	PARAM.VALUE	-00.404	-0.387	0.938	21	0.48	1.1[illegible]	0.33	0.354100	7.011	0.001
	STD ERROR	11.131	1.000	1.100							
	t STATISTIC	-2.769	-0.301	3.010							
EC	PARAM.VALUE	-1.017	0.100	1.001	11	0.14	1.11	1.41	0.123771	13.010	0.144
	STD ERROR	0.[illegible]4	0.470	0.040							
	t STATISTIC	-0.[illegible]1	[illegible].349	1.007							
RWE	PARAM VALUE				1					0.047	0.000
	STD ERROR										
	t STATISTIC										
ME/NA	PARAM VALUE	4.704	0.034	0.131	21	0.10	2.41	1.71	0.002017	08.170	0.708
	STD ERROR	0.013	0.383	0.513							
	t STATISTIC	0.000	1.160	0.490							
FE	PARAM VALUE	87.101	-1.428	-0.[illegible]1	13	0.66	1.25	9.10	0.301303	0.140	0.001
	STD.ERROR	10.047	0.111	1.000							
	t STATISTIC	1.113	-4.371	-1.426							
OCE	PARAM VALUE	14.010	-3.710	-1.110	11	0.10	1.30	11.40	0.107101	3.030	0.040
	STD ERROR	28.148	1.103	1.008							
	t STATISTIC	0.011	-4.720	-0.190							
COMMU	PARAM VALUE				3					0.054	0.001
	STD.ERROR										
	t STATISTIC										
								Total		100.000	1.030

Table 5.11 Far East Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	#OBS	#RSQ	#DW	#FS1	UTHEIL	21 Year Average % Total Imports	21 Year Average % Total Market Demand
US	PARAM VALUE	-50 208	0 510	2 066	21	[illegible] 63	2.25	124 47	0 013586	81 284	2 201
	STD ERROR	3 [illegible]5	0 10[illegible]	0 254							
	t STATISTIC	-7 770	2.807	10 405							
CAN	PARAM.VALUE	-51 580	-2 840	3 [illegible]62	8	0.40	1.01	1 07	0.755101	0 042	[illegible] 001
	STD ERROR	41 751	1.502	2 096							
	t STATISTIC	-1 080	-1.050	1 102							
LA	PARAM VALUE	-45 210	-2.511	2 155	20	0 40	2 54	1 21	0.50011	0 205	0 000
	STD ERROR	31 301	0 951	2.01[illegible]							
	t STATISTIC	-1 384	-2 70[illegible]	1 584							
MED-EC	PARAM.VALUE	-24 [illegible]50	0 420	2 012	21	0.45	1.71	1 20	0 198224	[illegible] 540	0 010
	STD ERROR	12 177	0.815	0.855							
	t STATISTIC	-1 045	0.550	2.415							
EC	PARAM VALUE	-50 050	-5 015	4 004	20	0.32	1.12	4 00	0.093572	0 022	[illegible] 001
	STD ERROR	25 280	1 500	1 521							
	t STATISTIC	-2 520	-2 100	2 014							
RHE	PARAM VALUE	41 700	1.401	-2 012	12	0.54	0 02	2 50	0 284051	0 003	0 [illegible]00
	STD ERROR	18 245	0 150	1.188							
	t STATISTIC	2 280	1 050	-2 198							
ME/NA	PARAM VALUE	10 010	-0 102	-0.826	21	0 40	1 62	1 14	0.14505	7 575	0 220
	STD ERROR	1 088	0 278	[illegible] 457							
	t STATISTIC	1 411	-2.812	-0 058							
RAF	PARAM.VALUE	-25 010	-2 021	2 5[illegible]	21	[illegible].15	0 [illegible]	1 [illegible]	0 297011	5 520	0 102
	STD ERROR	44 401	1.000	2 014							
	t STATISTIC	-0 145	-1.011	0.055							
OCE	PARAM VALUE	-8 550	-0.125	1 120	21	0.16	0.10	1 01	0 328221	0.507	0 101
	STD ERROR	1[illegible] 302	0 520	0 5[illegible]							
	t STATISTIC	-0 [illegible]	-0 240	1 [illegible]90							
COMMB	PARAM VALUE	-80 284	-0.488	0 215	8	0 42	2 50	2 10	0 3465	0 002	0.000
	STD ERROR	54 [illegible]72	1 179	2 523							
	t STATISTIC	-1 781	-0 414	1 781							
								Total		100 000	2 001

Table 5.12 Oceania Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	#OBS	#RSQ	#DW	#FST	UTHEIL	21 Year % Total Imports	Average % Total Market Demand
US	PARAM VALUE	-23.433	-1 235	2.063	21	0.21	0 53	2.45	0.200045	85.922	3 342
	STD ERROR	18 241	0 793	1 404							
	t STATISTIC	-1 285	-1 558	1 782							
CAN	PARAM VALUE				0					0 000	0 000
	STD ERROR										
	t STATISTIC										
LA	PARAM VALUE	58 815	3 076	-4 127	7	0.72	2 04	5 10	0 110458	4 504	0 175
	STD ERROR	27 151	2 807	2.200							
	t STATISTIC	2.003	1 300	-1.000							
MED-EC	PARAM VALUE	-08 070	5 004	5.072	7	0.07	0 52	4.13	0.300675	1.060	0 073
	STD ERROR	71 041	2 053	5.020							
	t STATISTIC	-0 081	2 476	1.025							
EC	PARAM VALUE				5					0.027	0 001
	STD.ERROR										
	t STATISTIC										
RWE	PARAM VALUE				0					0 000	0 000
	STD ERROR										
	t STATISTIC										
ME/NA	PARAM VALUE	107 030	-0 500	-15.478	13	0.77	1 25	10 00	0 373281	4 078	0 100
	STD ERROR	55 400	1 154	4 520							
	t STATISTIC	3 550	-5 710	-3.424							
RAF	PARAM VALUE				0					2.626	0 103
	STD ERROR										
	t STATISTIC										
FE	PARAM VALUE	-22 288	-1 408	2 184	7	0.08	3 11	3 10	0 821817	0.175	0 007
	STD ERROR	83 076	4.445	0 744							
	t STATISTIC	-0 285	-0.317	0 312							
COMMB	PARAM VALUE				0					0 088	0.000
	STD ERROR										
	t STATISTIC										
								Total		100 000	3 800

Table 5.13 Communist Bloc Product Demands

Partner Region		Intercept (+\-)	Relative Price (-)	Total Market Demand (-\+)	@OBS	@RSQ	@DW	@FS1	UTHEIL	11 Year Average % Total Imports	11 Year Average % Total Market Demand
US	PARAM VALUE	3 112	-0 310	0 404	0	0 31	1.14	4.01	0 401010	0.400	0 202
	STD ERROR	32 601	3 001	1.414							
	t STATISTIC	0 000	-1 041	0.200							
CAN	PARAM VALUE				0					0.000	0 000
	STD ERROR										
	t STATISTIC										
LA	PARAM VALUE	-31 344	-3 401	3 313	20	0 44	1 00	0.10	0.11123	1 104	1 012
	STD ERROR	12 820	1.060	0.035							
	t STATISTIC	-2 000	-3.100	3 006							
MED-EC	PARAM VALUE	0 301	0 143	0 280	11	0 11	2 10	1.11	0 100231	33 102	20 520
	STD.ERROR	1 001	0.323	0.204							
	t STATISTIC	1 003	0 213	1,211							
EC	PARAM VALUE	-3 264	-2.100	0 025	11	0,20	1 50	1 24	0 203034	0 000	0 040
	STD.ERROR	7 307	1.331	0 353							
	t STATISTIC	-0 090	-1.430	1 014							
RWE	PARAM VALUE	-33 350	-0.333	4 130	13	0.43	0 31	4.30	0.010033	0 013	0.000
	STD ERROR	21 610	1.210	1 545							
	t STATISTIC	-2 478	-0.280	1 001							
ME/NA	PARAM VALUE	-2 003	-1.340	1 237	11	0.35	1 03	10 01	0 110001	01 430	33.030
	STD ERROR	3.000	0 311	0 200							
	t STATISTIC	-0 011	-4 113	4 111							
RAF	PARAM VALUE				2					0 003	0 002
	STD ERROR										
	t STATISTIC										
FE	PARAM VALUE	-103.470	0 171	1.047	0	0.30	0 02	1.30	0.570340	0.031	0 010
	STD ERROR	60 401	3 101	4 011							
	t STATISTIC	-1.540	1 432	1.011							
OCE	PARAM VALUE				4					0.001	0 001
	STD ERROR										
	t STATISTIC										
								Total		100 000	50 220

Table 5.14 United States CIF Price Linkage Equations

Partner Region		Intercept (+/-)	FOB Price (+)	Year Trend (-/+)	Energy Index Price (+)	#OBS	#RSQ	#DW	#FST	UTHEIL	21 Years % of Total Imports	Average % Total Market Demand
CAN	PARAM VALUE	-11 801	0 116	1 116	-6 111	21	0 61	2 26	11 12	0 161764	0 135	0 001
	STD ERROR	15.161	0.263	3.520	6.161							
	t STATISTIC	-1.115	2.211	1.116	-6.621							
LA	PARAM VALUE	20 161	1 016	-1 516	6.182	21	0 71	2.13	16 21	0.176176	83.616	2.161
	STD ERROR	10 321	0.116	2 116	6.161							
	t STATISTIC	1.651	2.263	-2.111	2.612							
MED-EC	PARAM VALUE	6.113	0 611	-1 111	0 163	21	1 63	2 36	72 36	0 111336	2 760	0 113
	STD ERROR	1 311	0 315	1 611	6.106							
	t STATISTIC	0 601	2 811	-0 611	1.163							
EC	PARAM VALUE	1 610	0 617	-0 272	0 617	21	1 61	1 37	11 11	1 131116	0 636	0 001
	STD ERROR	10.511	1 206	2.112	6.116							
	t STATISTIC	0.160	1.126	-1 111	6.320							
RWE	PARAM VALUE					6					6.011	6.161
	STD ERROR											
	t STATISTIC											
ME/NA	PARAM VALUE	-10 217	0 136	2.403	6.032	21	0 63	2.31	27.35	0 160622	11.765	6.361
	STD ERROR	6 315	0 331	1 153	6 160							
	t STATISTIC	-1 225	2 225	1.236	6.212							
RAF	PARAM VALUE					3					0.011	6.161
	STD ERROR											
	t STATISTIC											
FE	PARAM VALUE	6 561	1.131	-1 617	-6 613	11	1 61	1 61	11 56	1 611125	1 611	0 111
	STD ERROR	6 265	6 350	1.812	6.011							
	t STATISTIC	6 111	3 230	-1 036	-6 610							
OCE	PARAM VALUE	-6 961	1 161	1 116	-6 661	21	1 11	2 11	6 12	0 331221	0 101	0 103
	STD ERROR	16 015	6 110	3 621	6.332							
	t STATISTIC	-6 133	2 142	1 157	-6 251							
COMMB	PARAM VALUE					6					0 000	6 001
	STD ERROR											
	t STATISTIC											
									Total		100 006	2 621

Table 5.15 Canada CIF Price Linkage Equations

Partner Region		Intercept (+\-)	FOB Price (+)	Year Trend (-\+)	Energy Index Price (+)	#OBS	#RSQ	#DW	#FST	UTHEIL	21 Years % of Total Imports	Average % Total Market Demand
US	PARAM.VALUE	-15.060	0.215	3.002	0.010	21	0.91	1.82	20.55	0.00016	10.013	10.013
	STD ERROR	15.840	0.701	3.005	0.009							
	t STATISTIC	-0.901	0.215	0.909	0.205							
LA	PARAM VALUE	-19.021	0.190	3.902	0.154	21	0.91	1.05	30.33	0.123018	1.230	1.230
	STD ERROR	9.003	0.281	3.606	0.105							
	t STATISTIC	-2.033	0.018	1.007	1.010							
MED-EC	PARAM VALUE	-4.863	0.850	1.906	0.994	21	0.91	2.60	26.15	0.154021	1.916	1.019
	STD ERROR	9.611	0.321	2.320	0.198							
	t STATISTIC	-0.805	2.500	0.413	0.816							
EC	PARAM.VALUE	10.053	0.085	-0.010	0.301	21	0.61	2.12	31.50	0.315098	0.010	0.010
	STD ERROR	13.060	0.332	2.965	0.150							
	t STATISTIC	1.200	2.959	-1.302	2.001							
RWE	PARAM VALUE					0					0.000	0.080
	STD.ERROR											
	t STATISTIC											
ME/NA	PARAM VALUE	0.100	0.031	-0.080	0.005	21	0.80	2.13	30.80	0.101008	5.080	5.080
	STD ERROR	9.150	0.206	1.912	0.131							
	t STATISTIC	0.020	2.000	-0.080	0.098							
RAF	PARAM.VALUE	-0.645	1.056	0.300	-0.011	21	0.80	2.10	82.52	0.123011	3.000	3.000
	STD ERROR	1.106	0.503	1.119	0.192							
	t STATISTIC	-0.108	2.103	0.151	-0.051							
FE	PARAM VALUE	-1.558	0.056	0.306	0.003	21	0.80	1.16	80.80	0.093311	9.384	9.390
	STD ERROR	16.610	0.006	2.005	0.081							
	t STATISTIC	-6.100	2.003	0.150	0.031							
OCE	PARAM VALUE	3.828	0.353	-1.906	0.219	21	0.82	1.56	20.01	0.090580	0.094	0.060
	STD ERROR	1.391	0.303	1.010	0.005							
	t STATISTIC	0.801	0.025	-0.038	2.822							
COMMB	PARAM.VALUE					1					0.002	0.002
	STD ERROR											
	t STATISTIC											
									Total		100.000	100.000

Table 5.16 Latin America CIF Price Linkage Equations

Partner Region		Intercept (+)-1	FOB Price (+)	Year Trend (-)(+)	Energy Index Price (+)	#OBS	RBSQ	DW	SEST	UTHEIL	20 Years Average % of Total Imports	% Total Market Demand
US	PARAM VALUE	20.000	2.000	-5.062	-0.240	20	0.00	2.22	30.00	0.140829	00.135	0.050
	STD ERROR	26.140	0.320	4.000	0.260							
	t STATISTIC	0.400	2.240	-0.402	-0.020							
CAN	PARAM VALUE	9.030	0.009	-2.440	0.400	20	0.00	2.00	21.00	0.120440	0.544	0.000
	STD ERROR	00.000	0.205	4.300	0.200							
	t STATISTIC	0.504	2.500	-0.000	0.900							
MED-EC	PARAM VALUE	-0.403	0.726	0.120	0.000	20	0.00	2.03	10.20	0.100972	0.000	0.000
	STD ERROR	00.000	0.330	2.009	0.103							
	t STATISTIC	-0.004	2.150	0.040	0.020							
EC	PARAM VALUE	-3.003	0.905	0.005	0.004	20	0.40	2.50	32.00	0.004000	0.000	0.002
	STD ERROR	0.040	0.322	0.505	0.105							
	t STATISTIC	-0.440	3.020	0.400	0.034							
RWE	PARAM VALUE					1					0.040	0.000
	STD ERROR											
	t STATISTIC											
ME/NA	PARAM VALUE	-9.014	0.049	2.000	0.032	21	0.30	2.20	3.60	0.246082	2.000	0.000
	STD ERROR	20.433	0.530	6.502	0.220							
	t STATISTIC	-0.210	0.214	0.300	0.000							
RAF	PARAM VALUE					4					0.000	0.000
	STD ERROR											
	t STATISTIC											
FE	PARAM VALUE					0					0.262	0.000
	STD ERROR											
	t STATISTIC											
OCE	PARAM VALUE					2					0.000	0.000
	STD ERROR											
	t STATISTIC											
COMMB	PARAM VALUE	-7.000	0.400	0.640	0.106	21	0.00	2.20	10.00	0.100500	2.305	0.000
	STD ERROR	00.440	0.405	3.000	0.139							
	t STATISTIC	-0.484	0.840	0.443	0.320							
									Total		000.000	0.035

Table 5.17 Mediterranean-EC CIF Price Linkage Equations

Partner Region		Intercept (+)(-)	FOB Price (+)	Year Trend (-)(+)	Energy Index Price (+)	NOBS	RSQ	DW	FST	UTHEIL	21 Years % of Total Imports	Average % Total Market Demand
US	PARAM VALUE					5					0.005	0.000
	STD ERROR											
	t STATISTIC											
CAN	PARAM VALUE										0.000	0.000
	STD ERROR											
	t STATISTIC											
LA	PARAM VALUE	-28.750	0.000	5.000	0.100	21	0.10	1.84	20.03	0.103000	22.010	0.022
	STD ERROR	15.005	0.084	5.510	0.111							
	t STATISTIC	-1.010	0.103	1.030	0.010							
EC	PARAM VALUE	-11.012	0.222	2.025	0.050	21	0.51	2.54	1.66	0.100100	61.100	0.000
	STD ERROR	9.503	0.522	2.211	0.160							
	t STATISTIC	-1.105	0.024	1.001	0.351							
RWE	PARAM VALUE	-11.331	1.000	0.100	-0.280	21	0.00	2.72	26.70	0.082510	1.101	0.002
	STD ERROR	13.001	0.330	2.001	0.130							
	t STATISTIC	-1.333	3.210	1.000	-2.155							
ME/NA	PARAM.VALUE	21.000	1.102	-0.310	0.300	21	0.00	2.52	10.20	0.315843	11.660	0.010
	STD ERROR	20.016	0.002	0.005	0.200							
	t STATISTIC	1.310	2.000	-1.324	1.413							
RAF	PARAM.VALUE					5					0.013	0.010
	STD ERROR											
	t STATISTIC											
FE	PARAM.VALUE					2					0.310	0.000
	STD ERROR											
	t STATISTIC											
OCE	PARAM VALUE					1					0.042	0.000
	STD ERROR											
	t STATISTIC											
COMMU	PARAM VALUE					3					0.312	0.000
	STD ERROR											
	t STATISTIC											
									Total		100.000	0.100

Table 5.18 EC CIF Price Linkage Equations

Partner Region		Intercept (+)-1	FOB Price (+)	Year Trend (-\+)	Energy Index Price (+)	OBS	RSQ	DW	FST	UTHEIL	21 Years % of Total Imports	Average % Total Market Demand
US	PARAM VALUE	-2.260	0.000	0 000	0.120	21	0 05	2 10	31 10	0 007005	1 021	1.012
	STD ERROR	0 547	0 200	1 000	0 002							
	t STATISTIC	-0.260	2.103	0.205	1.051							
CAN	PARAM VALUE	0 200	1.021	-1 101	0 020	21	0 02	2 02	0 32	0 103100	0 002	0.002
	STD ERROR	10 000	0 060	3 070	0.183							
	t STATISTIC	0 003	2 183	-0 300	0 100							
LA	PARAM VALUE	-0.300	0.210	1 167	0 170	21	0 60	1 02	02 30	0.073032	3 270	3.260
	STD ERROR	7 100	0.211	1 001	0.070							
	t STATISTIC	-0 603	0 005	0 730	2 370							
MED-EC	PARAM VALUE	0 000	1.005	-1.400	-0 011	21	0 07	1 07	100 00	0 002002	00 102	03 000
	STD ERROR	3.022	0.147	0 071	0.051							
	t STATISTIC	2.210	7.241	-2 160	-0 220							
RWE	PARAM VALUE	2 582	1 270	-0 405	-0 121	21	0 70	2 20	15 07	0 00002	0 030	0 020
	STD ERROR	0 702	0 350	1 300	0 125							
	t STATISTIC	0 047	3.570	-0 300	-0 061							
ME/NA	PARAM VALUE	-2 000	1.053	0 071	-0.030	21	0 60	2 10	60.00	0 005405	32 000	32 040
	STD ERROR	3.150	0 200	0 700	0 000							
	t STATISTIC	-0 101	0 557	0 052	-0.007							
RAF	PARAM VALUE	-0 561	0 070	0 000	0 102	21	0 03	2 71	71 77	0 056000	7 001	7 000
	STD ERROR	0.033	0.200	0 000	0 068							
	t STATISTIC	-0.127	2 020	0 000	1 000							
FE	PARAM VALUE	2.330	0.035	-0 070	-0 033	21	0 00	2 21	10 07	0 120001	0 001	0 007
	STD ERROR	0.070	0.200	2 110	0.157							
	t STATISTIC	0.260	5 015	-0 221	-0 212							
OCE	PARAM. VALUE	0 020	0 000	0 105	-0 010	21	0 70	1 03	20 00	0 075077	0 100	0.100
	STD ERROR	5 702	0 300	1.000	0 100							
	t STATISTIC	0 102	2.205	-0.105	-0.002							
COMMB	PARAM VALUE	2 001	0 005	-0 002	0.002	21	0 00	2 30	00 30	0 05000	0 101	0 100
	STD ERROR	0 090	0 200	1.001	0 072							
	t STATISTIC	0 620	3 011	-0.040	0 000							
									Total		100.000	00.560

Table 5.19 Rest of Western Europe CIF Price Linkage Equations

Partner Region		Intercept (+)-1	FOB Price (+)	Year Trend (-\+)	Energy Index Price (+)	#OBS	#RSQ	#DW	#FST	UTHEIL	21 Years Average % of Total Imports	21 Years Average % of Total Market Demand
US	PARAM VALUE	-0 310	0 032	0 014	0 123	21	0 00	1 36	52 20	0 001084	0 001	0 001
	STD ERROR	0 050	0.201	1.501	0 000							
	t STATISTIC	-0 000	2 305	0 000	1 100							
CAN	PARAM VALUE					0					0 060	0 000
	STD ERROR											
	t STATISTIC											
LA	PARAM VALUE	-11 380	0.000	3.865	0 150	21	0 07	1.81	201 81	0.000011	1 022	1.022
	STD ERROR	1 005	0.215	1.500	0.000							
	t STATISTIC	-2 001	0.185	2.300	3.311							
MED-EC	PARAM VALUE	-0 105	0.083	1.132	-0 000	21	0 08	1.30	243 85	0 040001	03 012	03 012
	STD ERROR	2 502	0.122	0.560	0.000							
	t STATISTIC	-1 001	1.005	1.901	-0.103							
EC	PARAM VALUE	8 083	1 301	-1 130	-0 012	21	0 01	2 81	20 70	0 080000	1 501	1 501
	STD ERROR	0 181	0.200	1.112	0.082							
	t STATISTIC	1 001	4.305	-1.503	-0 129							
ME/NA	PARAM VALUE	-0 511	1.010	1.211	-0 001	21	0 00	1.80	300.62	0 020	01 501	01 501
	STD ERROR	1 052	0.132	0.032	0 035							
	t STATISTIC	-2 305	8 150	2 010	-1 330							
RAF	PARAM VALUE	-2 233	0 050	0.020	0.122	21	0 00	2.21	225.00	0.032015	5 321	5 327
	STD ERROR	2 033	0 135	0 550	0 000							
	t STATISTIC	-0 018	0 001	0.180	2.050							
FE	PARAM VALUE	-8 018	0.031	1.530	-0.020	21	0 08	2.70	11.00	0.100110	0 030	0 030
	STD ERROR	10 000	0 201	2 530	0.100							
	t STATISTIC	0 000	2 050	0 601	-0 125							
OCE	PARAM VALUE	1 150	0 944	-1.800	0.230	21	0 01	2.53	50.10	0.050018	0 103	0 102
	STD ERROR	0 050	0 245	1.020	0 001							
	t STATISTIC	1 100	2 821	-1 800	2 120							
COMM	PARAM VALUE	-3 108	0 600	0.021	0.000	21	0 94	2.11	00 05	0 00090	0 000	0 000
	STD ERROR	5 302	0.150	1.210	0.051							
	t STATISTIC	-0 580	3.020	0.515	1.132							
									Total		100.000	100.000

Table 5.20 Middle East/North Africa CIF Price Linkage Equations

Partner Region		Intercept (+\-)	FOB Price (+)	Year Trend (-\+)	Energy Index Price (+)	#OBS	RBSQ	DW	%PST	UTHEIL	27 Years % of Total Imports	Average T Total Market Demand
US	PARAM VALUE	0.707	0.003	0.033	-0.007	27	0.27	2.44	7.03	0.708752	7.403	0.023
	STD ERROR	27.620	0.465	0.034	0.412							
	t STATISTIC	0.007	2.014	0.000	-0.003							
CAN	PARAM VALUE					0					0.000	0.000
	STD ERROR											
	t STATISTIC											
LA	PARAM VALUE	-2.302	0.730	0.007	0.040	27	0.00	2.34	42.00	0.701775	74.020	0.334
	STD ERROR	10.023	0.390	2.334	0.772							
	t STATISTIC	-0.227	2.010	0.277	0.428							
MED-EC	PARAM VALUE	72.743	0.700	-3.040	0.231	27	0.64	2.73	0.60	0.481407	6.377	0.707
	STD ERROR	13.267	0.408	3.720	0.200							
	t STATISTIC	0.007	1.830	-0.073	0.000							
EC	PARAM VALUE	-10.207	0.872	2.450	-0.000	27	0.77	2.40	13.00	0.798000	7.722	0.020
	STD ERROR	13.007	0.300	3.240	0.700							
	t STATISTIC	-0.732	2.000	0.756	-0.001							
RWE	PARAM VALUE	15.652	1.707	-3.502	0.205	27	0.57	3.04	0.65	0.208400	7.040	0.047
	STD ERROR	21.003	0.403	0.000	0.217							
	t STATISTIC	0.778	2.474	-0.710	0.043							
RAF	PARAM VALUE	-4.577	0.433	0.740	0.757	27	0.90	2.20	52.72	0.070073	20.487	0.037
	STD ERROR	4.003	0.777	7.700	0.007							
	t STATISTIC	-0.078	2.430	0.640	7.040							
FE	PARAM VALUE	10.102	1.243	-2.223	0.704	27	0.50	3.77	0.00	0.200771	30.474	0.003
	STD ERROR	70.300	0.300	3.007	0.244							
	t STATISTIC	0.003	3.407	-0.000	0.075							
OCE	PARAM VALUE	70.703	7.004	-3.070	0.250	27	0.52	2.34	6.23	0.222027	4.220	0.005
	STD ERROR	72.024	0.407	2.007	0.104							
	t STATISTIC	7.377	2.747	-7.377	1.408							
COMMB	PARAM VALUE	6.900	7.407	-2.040	-0.073	27	0.77	2.05	13.07	0.204020	0.054	0.007
	STD ERROR	22.007	0.000	4.907	0.200							
	t STATISTIC	0.452	2.347	-0.477	-0.300							
									Total		100.000	2.237

Table 5.21 Rest of Africa CIF Price Linkage Equations

Partner Region		Intercept (+\-)	FOB Price (+)	Year Trend (-\+)	Energy Index Price (+)	@OBS	@RSQ	@DW	@FST	UTHEIL	21 Years % of Total Imports	Average % Total Market Demand
US	PARAM VALUE	-1.312	1.033	0.418	-0.003	21	0.91	1.05	11.26	0.103058	0.105	0.002
	STD ERROR	10.281	0.200	2.414	0.183							
	t STATISTIC	-0.154	3.436	0.100	-0.301							
CAN	PARAM VALUE					0					0.000	0.000
	STD ERROR											
	t STATISTIC											
LA	PARAM VALUE	-2.300	1.028	0.115	-0.053	21	0.80	1.11	42.14	0.109284	5.080	0.001
	STD ERROR	1.200	0.135	1.003	0.101							
	t STATISTIC	-0.353	1.011	0.424	-0.544							
MED-EC	PARAM VALUE	-23.144	0.130	5.108	-0.116	21	0.61	2.03	11.14	0.140082	1.012	0.081
	STD ERROR	13.310	0.402	3.038	0.120							
	t STATISTIC	-1.880	0.203	1.600	-0.800							
EC	PARAM VALUE	0.403	1.001	0.060	-0.072	21	0.00	1.10	140.20	0.032002	15.050	0.144
	STD ERROR	2.124	0.101	0.612	0.053							
	t STATISTIC	0.111	3.100	0.101	-1.312							
RWE	PARAM VALUE					1					0.047	0.000
	STD ERROR											
	t STATISTIC											
ME	PARAM VALUE	-11.631	0.310	2.000	-0.084	21	0.03	1.15	32.00	0.080431	80.110	0.108
	STD ERROR	5.131	0.218	1.302	0.000							
	t STATISTIC	-2.031	2.000	2.013	-0.852							
FE	PARAM VALUE	-10.030	1.300	2.001	-0.223	21	0.43	2.58	4.31	0.200405	0.140	0.002
	STD ERROR	12.033	0.304	3.033	0.202							
	t STATISTIC	-0.163	2.100	0.800	-1.000							
OCE	PARAM VALUE	-0.542	1.230	2.351	-0.203	21	0.15	2.24	18.05	0.201400	3.030	0.040
	STD ERROR	0.133	0.311	2.235	0.216							
	t STATISTIC	-0.833	3.240	1.008	-0.040							
COMMB	PARAM VALUE					3					0.054	0.001
	STD ERROR											
	t STATISTIC											
									Total		100.000	1.030

Table 5.22 Far East CIF Price Linkage Equations

Partner Region		Intercept (+)-1	FOB Price (+)	Year Trend (-\+)	Energy Index Price (+)	NOBS	RSQ	DW	FTEST	UTHEIL	21 Years % of Total Imports	Average % Total Market Demand
US	PARAM VALUE	-0.160	0.702	0.090	-0.016	21	0.02	2.01	70.04	0.054252	81.304	2.361
	STD ERROR	0.522	0.300	1.424	0.082							
	t STATISTIC	-0.020	2.580	0.080	-0.253							
CAN	PARAM VALUE	11.300	0.702	-2.003	0.150	21	0.03	2.12	27.20	0.113127	0.043	0.001
	STD ERROR	31.266	0.104	2.605	0.117							
	t STATISTIC	0.002	4.202	-0.080	1.257							
LA	PARAM VALUE	-4.072	0.007	1.250	-0.000	21	0.70	2.11	21.00	0.170002	0.305	0.000
	STD ERROR	0.000	0.370	2.257	0.132							
	t STATISTIC	-0.503	2.532	0.003	-0.034							
MEO-EC	PARAM VALUE	3.120	0.017	-0.000	0.011	21	0.04	2.01	05.22	0.041032	0.040	0.010
	STD ERROR	7.214	0.405	1.025	0.007							
	t STATISTIC	0.432	2.207	0.420	0.200							
EC	PARAM VALUE	11.025	0.005	-2.052	0.122	21	0.00	2.20	0.20	0.12120	0.022	0.001
	STD ERROR	13.630	0.302	2.143	0.144							
	t STATISTIC	0.003	3.723	0.844	0.002							
RWE	PARAM VALUE	-4.203	0.725	0.007	-0.002	21	0.01	3.40	23.00	0.130000	0.003	0.000
	STD ERROR	11.484	0.300	2.001	0.114							
	t STATISTIC	-0.270	2.025	0.305	-0.014							
ME/NA	PARAM VALUE	14.264	2.522	-2.000	-0.100	21	0.07	2.25	20.40	0.13241	7.075	0.220
	STD ERROR	13.500	0.707	2.002	0.100							
	t STATISTIC	1.064	2.333	-0.877	-1.400							
RAF	PARAM VALUE	-4.200	0.600	0.010	0.062	21	0.06	2.00	120.70	0.04477	3.020	0.102
	STD ERROR	0.721	0.377	2.123	0.004							
	t STATISTIC	-0.430	1.501	0.432	0.062							
OCE	PARAM VALUE	+3.072	0.400	0.703	0.112	21	0.00	2.16	123.62	0.036063	6.007	0.101
	STD ERROR	3.560	0.211	0.702	0.044							
	t STATISTIC	-1.032	2.500	0.065	2.510							
COMMD	PARAM VALUE	0.200	0.612	0.110	0.077	21	0.00	2.10	42.24	0.070806	0.002	0.000
	STD ERROR	4.576	0.244	1.042	0.001							
	t STATISTIC	0.063	2.512	-0.112	0.040							
									Total		100.000	2.901

Table 5 23 Oceania CIF Price Linkage Equations

Partner Region		Intercept (+\-)	FOB Price (+)	Year Trend (-\+)	Energy Index Price (+)	#OBS	#RSQ	#DW	#FST	UTHEIL	21 Years % of Total Imports	Average % Total Market Demand
US	PARAM VALUE	-5 400	0.030	1.260	-0.011	21	0 00	2.11	40 21	0 000403	05 922	3 342
	STD ERROR	5 354	0.110	1.210	0.050							
	t STATISTIC	-1 025	3.512	1.042	-0.200							
CAN	PARAM VALUE					0					0.000	0.000
	STD ERROR											
	t STATISTIC											
LA	PARAM VALUE	-3 085	0.200	0 410	0 160	21	0 50	1 00	12 30	0.101043	4.504	0.175
	STD ERROR	1 011	0.324	1.044	0.110							
	t STATISTIC	-0.430	0.006	0.201	1.340							
MED-EC	PARAM VALUE	-1 034	0.131	1.520	0.251	21	0 60	2 43	22 42	0 100035	1 000	0.013
	STD.ERROR	11 132	0.442	2.616	0 140							
	t STATISTIC	-0 016	0 200	0 583	1.132							
EC	PARAM VALUE					5					0.021	0.001
	STD.ERROR											
	t STATISTIC											
XWE	PARAM VALUE					0						0.000
	STD ERROR											
	t STATISTIC											
ME/NA	PARAM VALUE	2 111	0 610	-0 120	0 150	21	0 05	1 05	10 50	0.444433	4.010	0.100
	STD ERROR	12 105	0.200	3.081	0.262							
	t STATISTIC	0 211	2 125	-0.233	0.004							
RAP	PARAM VALUE					6					2.020	0.102
	STD ERROR											
	t STATISTIC											
FE	PARAM.VALUE	0 121	0 001	-0 003	0 015	21	0 46	2 10	4 00	0.311531	0.115	0.001
	STD ERROR	14 103	0 400	3.320	0.211							
	t STATISTIC	0 000	1.054	-0.001	0 350							
OCE	PARAM.VALUE					0					0.000	0.000
	STD ERROR											
	t STATISTIC											
									Total		100.000	[illegible]

Table 5.24 Communist Bloc CIF Price Linkage Equations

Partner Region		Intercept (+/-)	FOB Price (+)	Year Trend (-/+)	Energy Index Price (+)	NOBS	RBSQ	DW	FST	UTHEIL	20 Years % of Total Imports	Average % Total Market Demand
US	PARAM VALUE	[illegible]	1.244	[illegible]	[illegible]	[illegible]	[illegible]	2.04	[illegible]	[illegible]	[illegible]	[illegible]
	STD ERROR	[illegible]	0.354	[illegible]	[illegible]							
	t STATISTIC	[illegible]	[illegible]	-6.431	[illegible]							
CAN	PARAM VALUE										[illegible]	[illegible]
	STD ERROR											
	t STATISTIC											
LA	PARAM VALUE	[illegible]	[illegible]	-2.026	0.004	[illegible]	0.92	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	STD ERROR	[illegible]	[illegible]	2.357	[illegible]							
	t STATISTIC	[illegible]	[illegible]	[illegible]	[illegible]							
MED-EC	PARAM VALUE	[illegible]	[illegible]	[illegible]	-0.631	[illegible]	0.86	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	STD ERROR	[illegible]	[illegible]	[illegible]	[illegible]							
	t STATISTIC	[illegible]	[illegible]	[illegible]	[illegible]							
EC	PARAM VALUE	[illegible]	[illegible]	0.001	[illegible]	21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	STD ERROR	6.423	[illegible]	[illegible]	[illegible]							
	t STATISTIC	[illegible]	2.063	0.000	[illegible]							
RWE	PARAM VALUE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.32	[illegible]	3.72	[illegible]	[illegible]	[illegible]
	STD.ERROR	[illegible]	[illegible]	[illegible]	0.235							
	t STATISTIC	[illegible]	[illegible]	[illegible]	[illegible]							
ME/NA	PARAM VALUE	[illegible]	[illegible]	-0.406	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	STD ERROR	[illegible]	[illegible]	[illegible]	[illegible]							
	t STATISTIC	[illegible]	[illegible]	[illegible]	[illegible]							
RAF	PARAM VALUE					3					[illegible]	[illegible]
	STD ERROR											
	t STATISTIC											
FE	PARAM VALUE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	STD.ERROR	[illegible]	[illegible]	2.420	[illegible]							
	t STATISTIC	[illegible]	[illegible]	[illegible]	[illegible]							
OCE	PARAM VALUE					4					0.002	[illegible]
	STD ERROR											
	t STATISTIC											
									Total		[illegible]	[illegible]

The first column of Table 5.1 and 5.2 shows the name of the regions. The second column explains the meaning of the values appearing under each variable. The first value corresponds to the parameter, the second to the standard error, and the third to the "t" statistic. The following columns display the name of the variables included in the estimation, the statistics of the estimation, and percentages showing the relative importance of each region in fresh orange world consumption and trade.

Table 5.1 includes an intercept and four variables, average market price, real GDP, population level, and substitute product price. Table 5.2 includes an intercept and two variables, FOB average export price, and total fresh production. The following five columns in both tables show the number of observations and statistics used to evaluate the general performance of the model for each equation. The statistics included are the R square, the Durbin Watson, the F Test, and Theil's inequality coefficient. The last two columns in Table 5.1 display percentages that show the importance of each region with respect to total world demand and total world imports, respectively. The last column in Table 5.2 presents a percentage that shows the importance of each region with respect to total world exports of fresh oranges.

Tables 5.3 to 5.13 show the results for the product demand equations. Each table corresponds to one region with a maximum of ten estimated equations. The definition of a product for Armington's model in any of the regions refers to the same type of good but differentiated by country or region of origin. For example, a fresh orange from the United States is assumed to be perceived differently by EC consumers than a fresh orange from the Mediterranean-EC.

Given that the model includes a total of 11 regions, there will be at least ten product demand equations per region. Each product demand will represent the region's demand for fresh oranges originating in the other ten regions. Each table represents one final market or importing region The names of the partners or regions of origin are shown in the first column. The second column explains the values appearing under each variable. The values are the same presented in Tables 5.1 and 5.2; i.e., parameter values, standard errors, and "t" statistics. The following columns display an intercept and the name of the variables included in the product demand equations for all regions. The variables are relative prices and total market demand. The following five columns show the number of observations and the same statistics used for total market demand and export supply equations. The last two columns show the relative importance of each partner region's exports to total imports and total market demand in the final market region, respectively. Estimated product demand equations are less than ten in some regions due to insufficient data points.

Tables 5.14 to 5.24 show the results for the CIF price linkage equations. Each table refers to one region with a maximum of ten estimated equations. CIF price linkage equations link every region's import price with the FOB export price for the rest of the regions in the model. Therefore, there are unique CIF and FOB prices for every trade flow. Consequently, as in the case for product demands, each region is associated with the other ten regions through an equation.

The basic structure of Tables 5.14 to 5.24 is the same as the one presented for Tables 5.3 to 5.13, and hence it will not be repeated here.

The differences are the number and type of variables included in the estimation of each set of equations. The variables for the CIF price linkage equations are the FOB export price, a yearly trend and an index price for energy. Given insufficient data points in some regions, the number of estimated equations is less than ten.

Empirical Results: Graphical Analysis

The following analysis provides a way to evaluate the ability of the model to predict the original data Figures for all total market demand and export supply equations as well as selected figures from relevant product demand equations are presented and evaluated. The graphical analysis presented here are complemented with a statistical and economic analysis of the empirical results in order to have a better criterion to judge the overall performance of the model. The statistical and economic analyses are presented in subsequent parts of this section of the chapter.

Figures 5.1 to 5.11 show the actual and fitted values of each region's total market demand equation. Figures 5.12 to 5.22 present the actual and fitted values for each one of the export supply equations. Figures 5.23 to 5.49 show the actual and fitted values of selected product demand equations. The product demand equations were selected on the basis of trade relevance to the fresh orange trade model. The figure units include thousands or millions of metric tons over time. Notice that the units of measurement vary throughout the different figures. It is important to take these differences into consideration when evaluating the model's prediction ability.

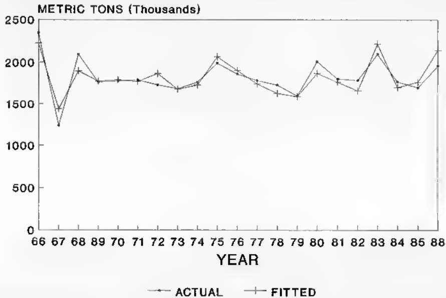

Figure 5.1. Total Market Demand for Fresh Oranges in the United States.

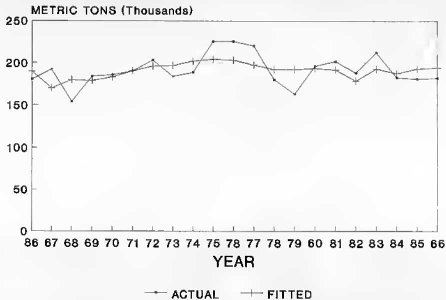

Figura 5.2. Total Market Demand for Fresh Oranges in Canada.

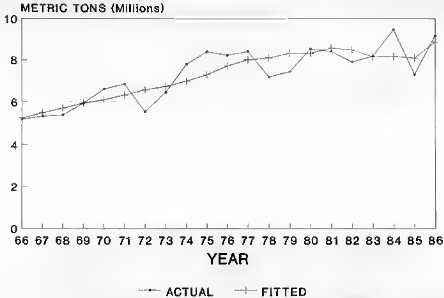

Figure 5.3. Total Market Demand for Fresh Oranges in Latin America

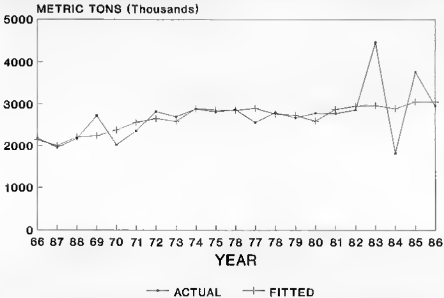

Figure 5.4. Total Market Demand for Fresh Oranges in the Mediterranean-EC.

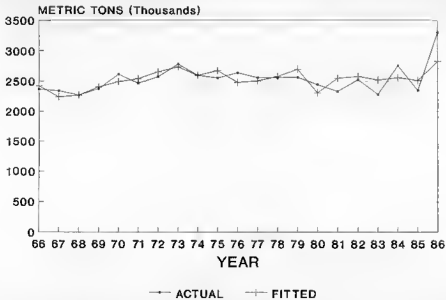

Figure 5.5. Total Market Demand for Fresh Oranges in the EC.

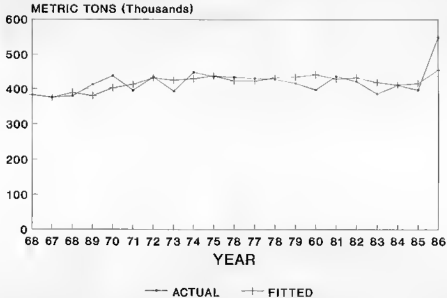

Figure 5.6. Total Market Demand for Fresh Oranges in the rest of Western Europe.

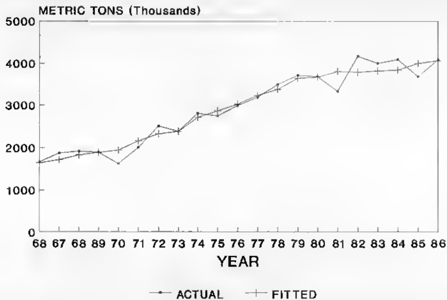

Figure 5.7. Total Market Demand for Fresh Oranges in the Middle East/North Africa

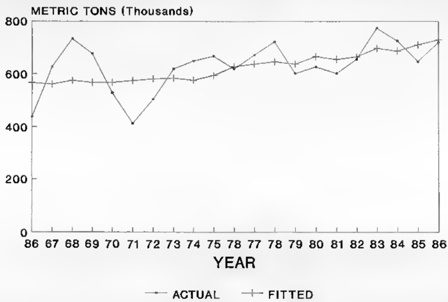

Figure 5.8. Total Market Demand for Fresh Oranges in the rest of Africe.

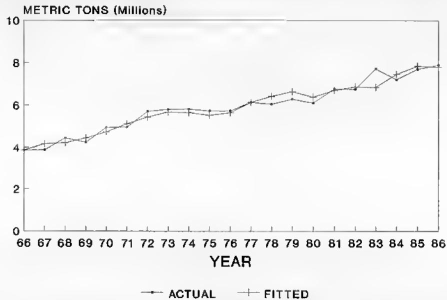

Figure 5.9 Total Market Demand for Fresh Oranges in the Far East.

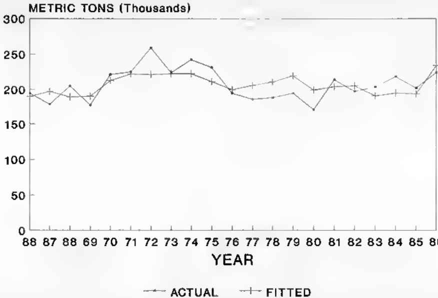

Figure 5.10. Total Market Demand for Fresh Oranges in Oceania

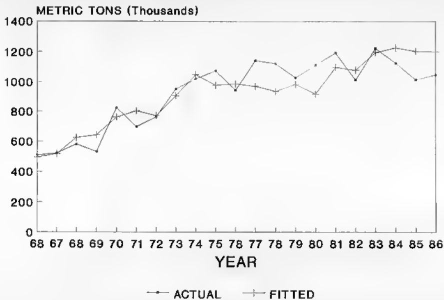

Figure 5.11. Total Market Demand for Fresh Oranges in the Communist Bloc.

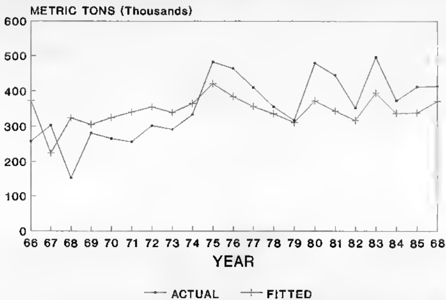

Figure 5.12. Total Export Supply of Fresh Oranges from the United States.

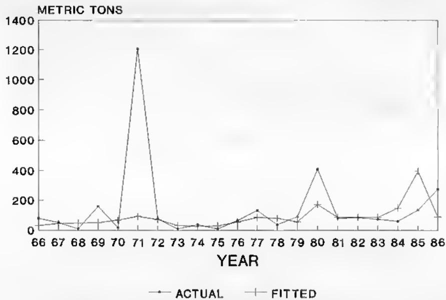

Figure 5.13. Total Export Supply of Fresh Oranges from Canada.

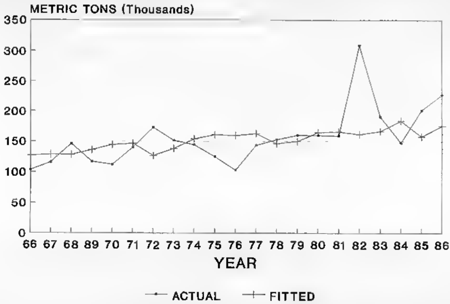

Figure 5.14. Total Export Supply of Fresh Oranges from Latin America.

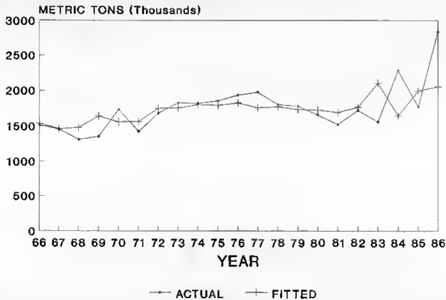

Figure 5.15. Total Export Supply of Fresh Oranges from the Mediterranean-EC.

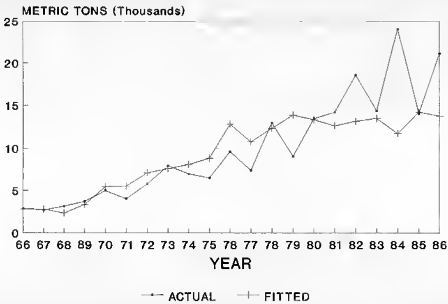

Figure 5.16. Total Export Supply of Fresh Oranges from EC.

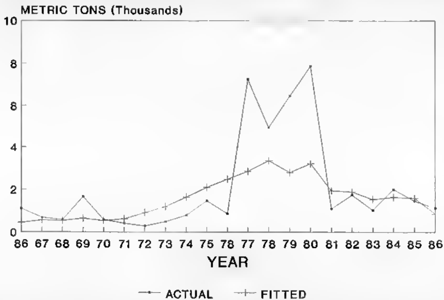

Figure 5.17. Total Export Supply of Fresh Oranges from the rest of Western Europe.

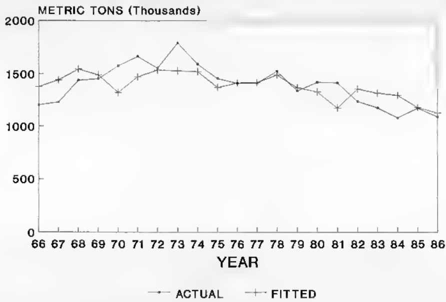

Figure 5.18 Total Export Supply of Fresh Oranges from Middle East/North Africa.

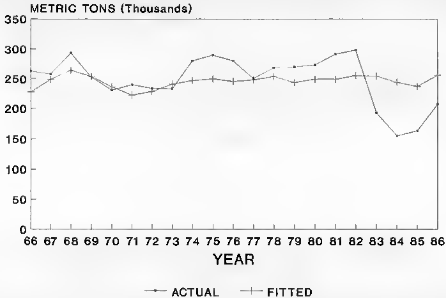

Figure 5.19. Total Export Supply of Fresh Oranges from the rest of Africa.

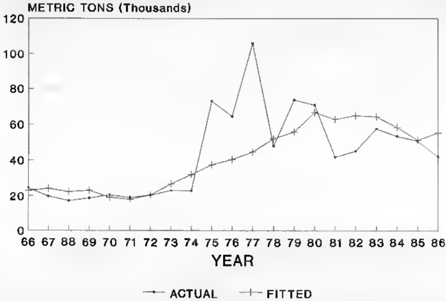

Figure 5.20. Total Export Supply of Fresh Oranges from the Far East.

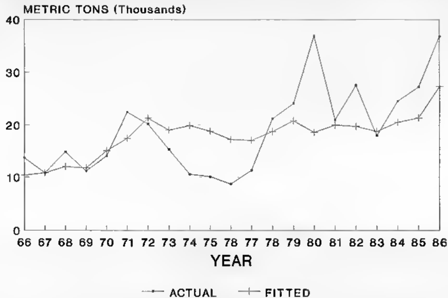

Figure 5.21. Total Export Supply of Fresh Oranges from Oceania.

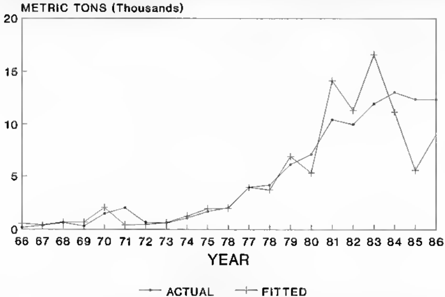

Figure 5.22. Total Export Supply of Fresh Oranges from the Communist Bloc.

Total market demand

Figures 5.1 to 5.11 show that the model captures the trend for the regions included in the model. The model has the ability to predict if a region has a growing total market demand or if the demand is decreasing over time. The results also show that the model predicts most turning points with few exceptions. The exceptions are Latin America, Mediterranean-EC, and the rest of Africa. These regions have in common that almost 100% of their total consumption comes from local production. The trade model developed here is mainly concerned with trade flows among regions.

Latin America is the largest producer of oranges and the largest consumer of fresh oranges within the reporting regions. This region, in particular Brazil, has developed a fast-growing orange-producing and processing industry in the last 20 years. These conditions generate a special effect that might have not been reflected by the model. The model assumption of independence between fresh and processed consumption could have been too restrictive for this region. In fact, it is possible to argue that consumption could have been dependent on how much of the orange production was processed. This argument, however, will not necessarily apply to other regions since they either have little Figure 5.1-5.22 orange production or have a slower growing orange-producing and processing industry.

Mediterranean-EC major turning points are generated by the model up to 1982. The model failed to capture the changes in demand that occurred after that year. Figure 5.4 shows that the changes in demand after 1982 are very unusual and probably related to changes that occurred that year

and the years after. Those changes culminated in 1986 with the admission of Spain and Portugal to the EC.

The rest of Africa consumption pattern has been very irregular over time and the model has been unsuccessful in reflecting the major turning points. This region is formed by one large producer and exporter (South Africa) and many countries that usually consume only what they produce. Imports in this region are very small as compared to total market demand. Turning points in this region's total market demand are probably related to exogenous changes in local production of oranges and therefore are not predicted by the model.

Export supply

Figures 5.12 to 5.22 show that the model generates the trend of the export supply equations for every region in the model. The model has the ability to predict if a region has a growing export supply or if the export supply is decreasing over time. The results also show that the model does not capture the turning points as well as it did for total market demand equations with some exceptions. The model does reflect most of the turning points for the United States, Mediterranean-EC, and Middle East/North Africa. These regions represented 88% of total world exports between 1966 and 1986.

Product demand

The third group of figures show the actual and fitted values for selected product demand equations. Total trade for selected regions represented over 90% of total world trade in the 21-year period

considered. Total imports per region relative to total world imports are shown in Table 5.1. Imports from each partner relative to total imports in a given region are shown in Tables 5.3 to 5.13. The figures will be examined and discussed on a region-by-region basis.

United States. United States total imports represented 1.2% of total world imports in the period studied. Figures 5.23 and 5.24 show the demand for Latin America and Middle East/North Africa products in the United States, respectively. The figures show that, in both cases, the model predicts the trend as well as some of the major turning points. The demand for the Latin America product had an unusual peak during 1982 that was not generated by the model. The demand for the Middle East/North Africa product has been irregular. However, the model captures the trend and most turning points

Canada. Canada imported 4.8% of total world imports in the 21-year period considered. Figures 5.25 to 5.27 display the demand for the United States, Middle East/North Africa, and Far East products in Canada, respectively. The model shows the ability to predict the trend in every case. The demand for the Far East product is replicated quite well. The model is not predicting well some turning points for the United States and Middle East/North Africa products.

Latin America. Latin America imports represented 0.06% of total world imports for the period considered. Figures 5.28 and 5.29 exhibit the demand for the United States and EC products in Latin America, respectively. The estimated product demands reflect the trends over time.

The demand for United States product is replicated quite well. The model is not predicting some turning points in the case of the EC product demand.

Mediterranean-EC. Mediterranean-EC represented 0.07% of total world imports from 1966 to 1986. Figures 5.30 and 5.31 show the demand for Latin America and EC products in the Mediterranean-EC, respectively. The model generates the trend in both cases. Major turning points for the EC product demand are also captured by the model. Even though the EC is not a major producer of oranges, it does have some production and trade with other regions of the world. Some Latin America product demand's turning points are not reflected by the model. However, trade between Latin America and the Mediterranean-EC was negligible until 1980. This could be a partial explanation for the failure of the model in replicating the data in this particular case.

EC. EC represented 63.4% of total world imports in the period considered. Figures 5.32 to 5.34 show the demand for Mediterranean-EC, Middle East/North Africa, and the rest of Africa products in the EC, respectively. The model predicts the trend in every case. Figures 5.32 indicate that it also generates most turning points for the case of the Mediterranean-EC. The demand for the Mediterranean-EC product in the EC represented 35% of total world trade and 55% of EC's total imports Figures 5.33 and 5.34 show a good general fit, but some turning points are not captured by the model.

Rest of Western Europe. Rest of Western Europe imports represented 10.6% of total world imports in the 21-year period considered. Figures 5.35 to 5.37 present the demand for Mediterranean-EC, Middle East/North

Africa, and the rest of Africa products in the rest of Western Europe respectively. The three product demands show that the model reflects the trend. The best fit is obtained by the demand for Middle East/North Africa product for which turning points are predicted by the model. The demand for Mediterranean-EC product shows that the model generates only some turning points, and for the rest of Africa product shows that just a few turning points are captured.

Middle East/North Africa. Middle East/North Africa imports represented 1.65% of total world imports from 1966 to 1986. The region has been growing rapidly in terms of total market demand and trade in the last 15 years. Figures 5.38 to 5.40 display the demand for Latin America, rest of Africa, and Far East products in the Middle East/North Africa respectively. The model reflects the trend of the product demands in every case, but it is not predicting some turning points in each equation.

Rest of Africa. Rest of Africa imports represented 0.16% of total world imports in the period considered. Figures 5.41 and 5.42 exhibit the demand for EC and Middle East/North Africa products in the rest of Africa, respectively. The model generates the trend in both cases. The figures indicate that several turning points in each product demand are not captured by the model.

Far East. Far East imports represented 4.3% of total world imports in the 21-year period studied. This market has been growing fast in the last two decades. Figures 5.43 to 5.45 show the demand for the United States, Middle East/North Africa, and Oceania products in the Far East, respectively. Figure 5.43 shows that the model closely reflects the demand for the United States product in the Far East. Figures 5.44 and

5.45 show that the model predicts the trend for the demands of Middle East/North Africa and Oceania products in the Far East. However, in the last two cases the model is not generating some of the turning points in each equation.

Oceania. Oceania represented .2% of total world imports in the period studied. Figures 5.46 and 5.47 display the demand for the United States and Middle East/North Africa products in Oceania, respectively. Figure 5.46 indicates that the model is capturing the trend and major turning points for the United States quite well. On the other hand, Figure 5.47 shows an irregular trade that went to zero in 1983. In this case, the model reflects the general trend but fails to predict some of the turning points.

Communist Bloc. Communist Bloc imports represented 13.6% of total world imports between 1966 and 1986. Figures 5.48 and 5.49 present the demand for Mediterranean-EC and Middle East/North Africa products in the Communist Bloc. Both figures show that the model has the ability to predict the trend. Figure 5.48 indicates that some turning points for the demand of the Mediterranean-EC product are not generated by the model. However, Figure 5.49 indicates that most turning points for the product coming from the Middle East/North Africa are captured by the model.

Conclusion: graphical analysis

The graphical analysis presented indicates that the model has the ability to predict the trends for nearly all equations. Some turning points were not, however, captured by the model. Over 60% of the

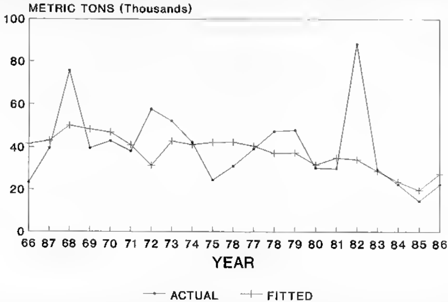

Figure 5.23. United States Imports of Fresh Oranges from Latin America (Product Demand 1_3).

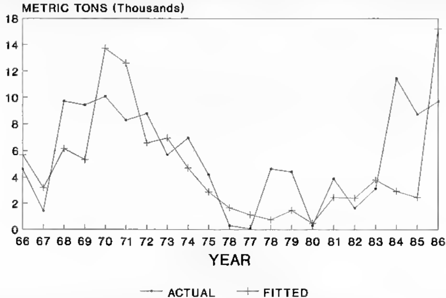

Figure 5.24. United States Imports of Fresh Oranges from the Middle East/North Africa (Product Demand 1_7).

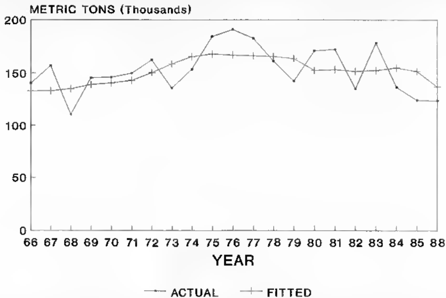

Figure 5.25 Canada Imports of Fresh Oranges from the United States (Product Demand 2_1).

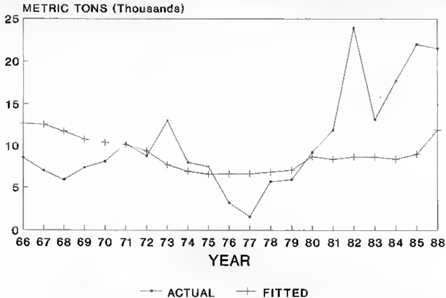

Figure 5 26 Canada Imports of Fresh Oranges from the Middle East/North Africa (Product Demand 2_7).

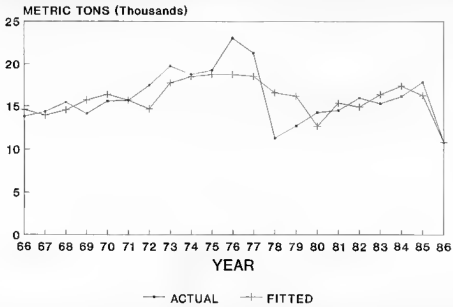

Figure 5.27. Canada Imports of Fresh Oranges from the Far East (Product Demand 2_9).

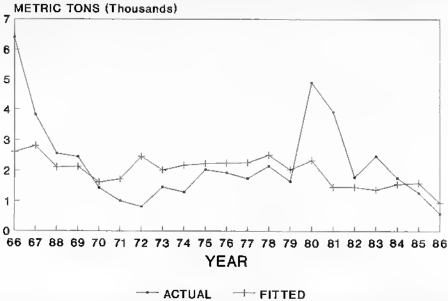

Figure 5.28. Latin America Imports of Fresh Oranges from the United States (Product Demand 3_1).

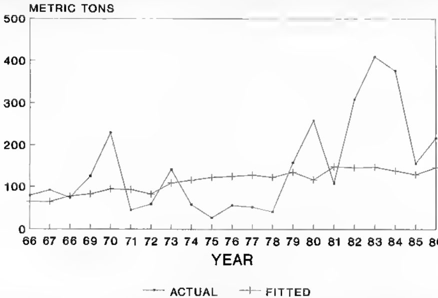

Figure 5.29. Latin America Imports of Fresh Oranges from the EC (Product Demand 3_5).

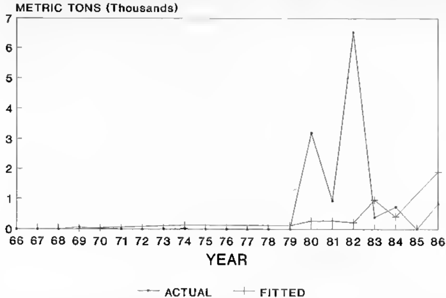

Figure 5.30. Mediterranean-EC Imports of Fresh Oranges from Latin America (Product Demand 4_3).

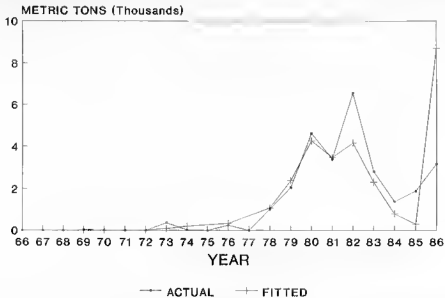

Figure 5.31. Mediterranean-EC Imports of Fresh Oranges from the EC (Product Demand 4_5).

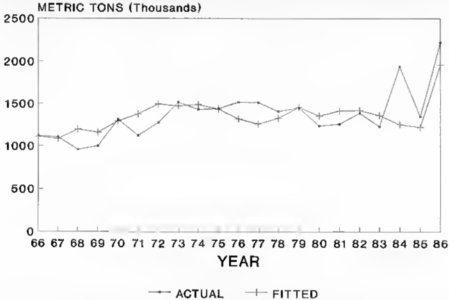

Figure 5.32. EC Imports of Fresh Oranges from the Mediterranean-EC (Product Demand 5_4).

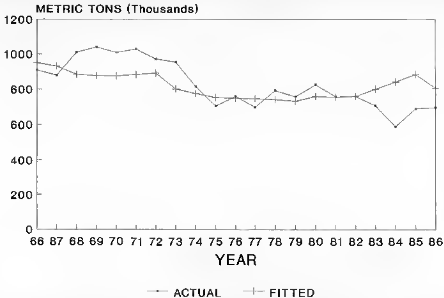

Figure 5.33 EC Imports of Fresh Oranges from the Middle East/North Africa (Product Demand 5_7).

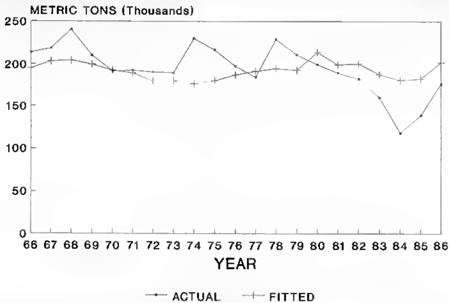

Figure 5.34. EC Imports of Fresh Oranges from the rest of Africa (Product Demand 5_8).

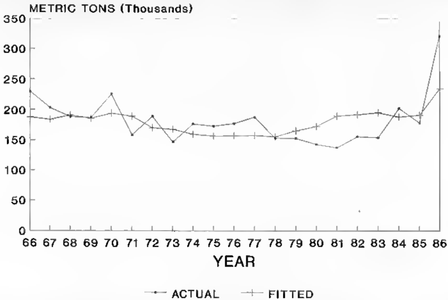

Figure 5.35. Rest of Western Europe Imports of Fresh Oranges from Mediterranean-EC (Product Demand 6_4).

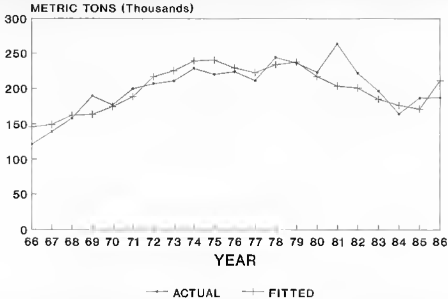

Figure 5.36 Rest of Western Europe Imports of Fresh Oranges from the Middle East/North Africa (Product Demand 6_7).

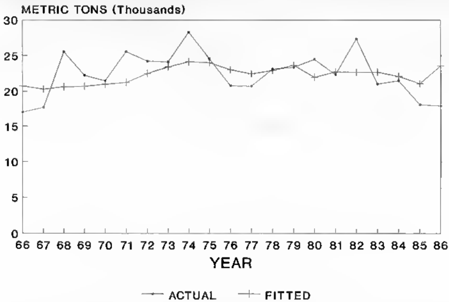

Figure 5.37. Rest of Western Europe Imports of Fresh Oranges from the rest of Africa (Product Demand 6_8).

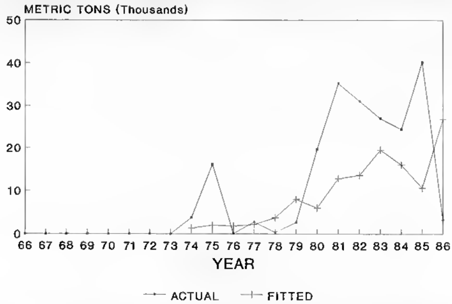

Figure 5.38. Middle East/North Africa Imports of Fresh Oranges from Latin America (Product Demand 7_3).

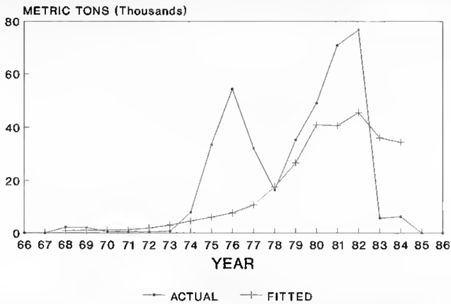

Figure 5.39. Middle East/North Africa Imports of Fresh Oranges from the rest of Africa (Product Demand 7_8).

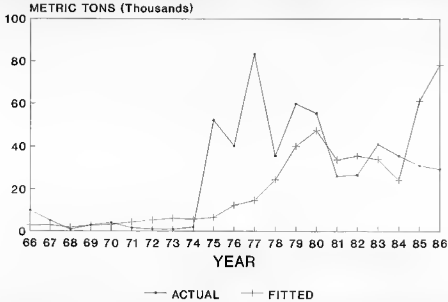

Figure 5.40. Middle East/North Africa Imports of Fresh Oranges from the Far East (Product Demand 7_9).

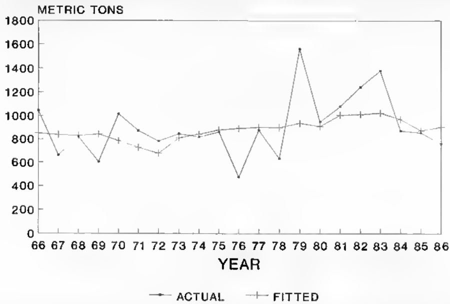

Figure 5.41. Rest of Africa Imports of Fresh Oranges from the EC (Product Demand 8_5).

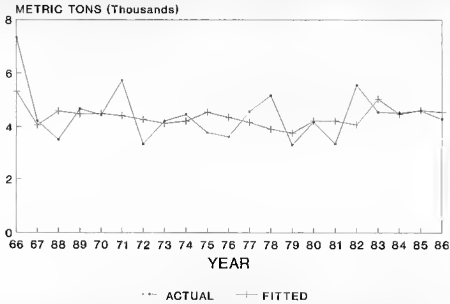

Figure 5.42. Rest of Africa Imports of Fresh Oranges from the Middle East/North Africa (Product Demand 8_7).

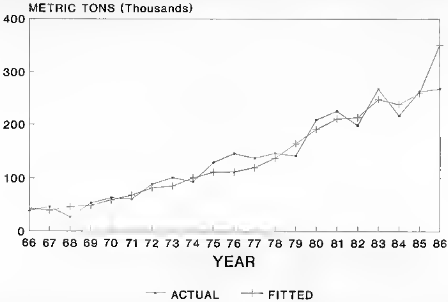

Figure 5.43. Far East Imports of Fresh Oranges from the United States (Product Demand 9_1).

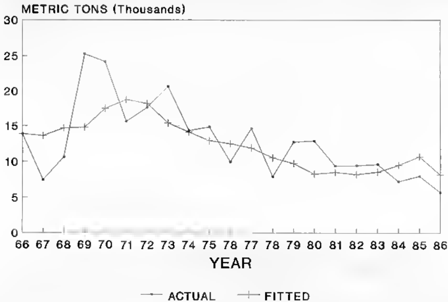

Figure 5.44. Far East Imports of Fresh Oranges from the Middle East/North Africa (Product Demand 9_7).

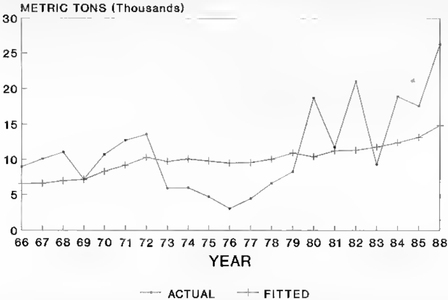

Figure 5.45. Far East Imports of Fresh Oranges from Oceania (Product Demand 9_10).

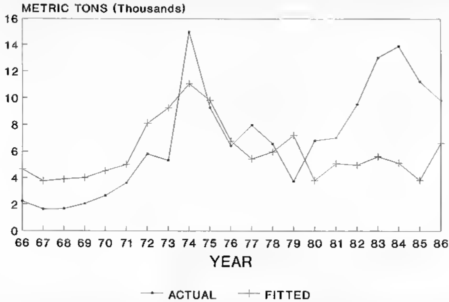

Figure 5.46. Oceania Imports of Fresh Oranges from the United States (Product Demand 10_1).

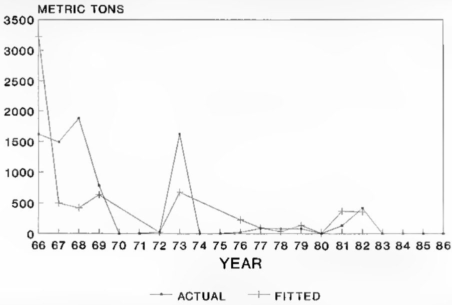

Figure 5.47. Oceania Imports from the Middle East/North Africa (Product Demand 10_7).

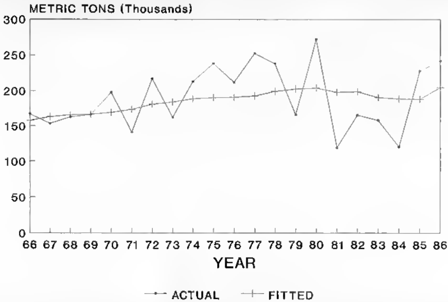

Figure 5.48. Communist Bloc Imports of Fresh Oranges from the Mediterranean-EC (Product Demand 11_4).

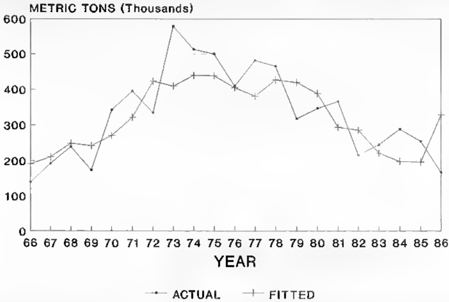

Figure 5 49. Communist Bloc imports of Fresh Oranges from the Middle East/North Africa (Product Demand il_7).

equations predicted most turning points. A quantitative statistic that measures the model's ability to predict or simulate major turning points will be introduced in the next section. The statistic will provide an additional criterion to judge the model performance for predictions.

Model predictions were better for total market demand equations than for export supply and product demand equations. Figures 5.1 to 5.11 show that the model reflects the trends and most turning points for the total market demand equations. The best predictions in the supply side corresponded to three regions whose exports combined represented 88% of total world exports from 1966 to 1986. In addition the main problems found in product demands were not related to significant trade flows, but were more related to regions with minimal trade flows.

Empirical Results: Statistical Analysis

In this section, the results will be analyzed using the statistics obtained from the estimation of the model. The criteria to evaluate an equation in multi-equation models are similar to the criteria used to evaluate single-equation regression models, even if a multi-equation estimation procedure was used. A nonlinear two-stage least squares was used to estimate the system of equations and each equation has an associated set of statistics.

Five statistics were selected to be included in the discussion over the performance of the fresh orange trade model. The statistics selected are the R square (@RSQ), the Durbin Watson (@DW), the F test (@FST), the Theil's Inequality Coefficient (UTHEIL), and the "t" statistic. The

following discussion will cover four of the five statistics. The "t" statistic will be evaluated in the fourth part of this section of the chapter together with the economic analysis of the parameter signs and magnitudes.

The @DW statistic is generally used to determined the existence and type of serial correlation in time series. If data are given on a yearly basis, as is the case for the fresh orange trade model, evidence of serial correlation would probably be related to model misspecification. If the @DW is close to two, then there is no evidence of misspecification.

A criterion that is used to evaluate a simulation model is the fit of the individual variables in a simulation context. It is expected that the results of a historical simulation match the behavior of the real world rather closely. It is therefore interesting to perform a historical simulation and examine how closely each endogenous variable tracks the historical data. This is especially important when the model is nonlinear, given the weakness of the @RSQ and @FST in those cases. Theil's Inequality Coefficient (UTHEIL) is a useful simulation statistic related to the RMS (Root-Mean-Square) simulation error and applied to the evaluation of historical simulations or ex post forecasts. The UTHEIL will give an idea on how well the model captures the turning points of the estimated equations. If the value of UTHEIL is zero, then the predicted value is equal to the actual value and there is a perfect fit. If UTHEIL is equal to one, then the predicted performance of the model is no better than a random estimate.

Tables 5.1 to 5.24 present the empirical results of the estimated fresh orange trade model and includes the major statistics discussed

above. Total market demand and export supply statistics are also highlighted in Table 5.25 to facilitate more detailed discussions. Tables H.1 to H.4 in Appendix H present the statistics for the product demand and CIF price linkage equations region by region.

Total market demand

Table 5.25 presents the statistics for total market demand and export supply equations. Two sets of six columns are included in Table 5.25. The first column describes the region name, the second the number of observations, the third the @RSQ, the fourth the @DW, the fifth the @FST, and the sixth the UTHEIL coefficient. The number of equations considered in each table is 11, one per region.

The number of observations used to estimate total market demand equations is 21 in all cases. There were sufficient data points for every variable in the whole range covered by the model. The period considered for the estimation was from 1966 to 1986.

The UTHEIL in all cases is far below .5 for total market demand equations. In general the model is reflecting the major turning points of the historical data. This is definitely an important result given the nonlinear nature of the model.

Export supply

Table 5.25 shows the export supply equations statistics. As mentioned above, a total of 11 equations are reported. Each region has one export supply equation associated with it.

Table 5.25 Total Market Demand and Export Supply Equations Statistics

	Total Market Demand					Total Export Supply				
Region	@OBS	@RSQ	@DW	@FST	UTHEIL	@OBS	@RSQ	@DW	@FST	UTHEIL
US	21	0.77	2.52	13.16	0.028457	21	0.20	1.71	2.19	0.106359
CAN	21	0.23	1.94	1.22	0.040323	21	0.28	2.68	3.49	0.636455
LA	21	0.78	1.83	14.22	0.042903	21	0.17	1.45	1.89	0.135310
MED-EC	21	0.37	3.27	2.38	0.085051	21	0.31	2.49	4.02	0.079362
EC	21	0.49	2.52	3.90	0.031023	21	0.82	1.41	41.36	0.172106
RWE	21	0.40	1.73	2.67	0.033662	21	0.49	1.24	8.75	0.355627
ME/NA	21	0.95	1.98	80.91	0.031826	21	0.43	1.11	6.72	0.050221
RAF	21	0.27	1.21	1.49	0.061481	21	0.06	0.55	0.53	0.077483
FE	21	0.95	2.40	79.89	0.023174	21	0.67	1.30	17.98	0.196981
OCE	21	0.35	1.49	2.20	0.042669	21	0.33	0.78	4.51	0.165562
COMMB	21	0.86	1.42	23.60	0.054849	21	0.85	1.52	51.55	0.165290

The UTHEIL indicates that all export supply equations have a coefficient far below .5 except for Canada. Overall, the model is predicting the major turning points of the historical data. Canada is a net importer and has no production of oranges; therefore, the results will not have an important impact on the fresh orange trade model.

Product demands and CIF price linkage equations

Tables H.1 to H.4 in Appendix H present the statistics for the product demand and CIF price linkage equations. Detailed region-by-region discussions about those statistics will not be included here.

Conclusion: statistical analysis

The statistical analysis shows that the model is capturing the major variations of the different dependent variables for each total market demand equation. Problems found were usually related to regions that will not affect the major driving issues of the fresh orange trade model.

The analysis also shows that the model is reflecting the major variations of the different dependent variables for total market demands better than it does for export supply equations. However, the results show that export supply equations for major world exporters are well captured by the model.

The reported statistics show that the model is predicting the major variations of the product demands better for which relevant trade took place. Important trade flows like Canadian imports from the United States, EC imports from the Mediterranean-EC and the Middle East/North

Africa, rest of Western Europe imports from the Middle East/North Africa and Mediterranean-EC, Far East imports from the United States, and Communist Bloc imports from the Middle East/North Africa and Mediterranean-EC; seem to be captured by the model. The CIF price linkage equations show better results than the ones obtained by the product demands. The model did not represent the rest of Africa data very well.

It is important to notice that, in almost every case, the UTHEIL coefficient was in acceptable ranges, indicating that major turning points in the data were captured by the model.

Empirical Results: Economic Analysis

In this section theoretical economic expectations and implications about signs and magnitudes and the "t" statistics associated with estimated coefficients are considered.

The probability distribution of estimators for small sample sizes in a system of simultaneous equations is unknown except for a few highly special cases (Judge et al., 1985). Therefore, the procedure utilized to estimate the fresh orange trade model implies that the estimated parameters are consistent but biased. Therefore, the "t" statistics obtained using NL2SLS can be used only to give some idea about the accuracy of the estimated parameters. Gujerati (1988) suggests that a "t" value in absolute terms greater than one would imply that the parameter is probably significant in a model such as the one used in this study. This guideline will be used in the following discussion.

In order to facilitate the presentation and discussion of the results, a new set of tables will be introduced. Table 5.26 shows the elasticities obtained from the total market demand and the export supply equations. Tables 5.27 and 5.28 present the relative price and total market demand elasticities obtained from the product demands. Tables 5.29, 5.30, and 5.31 present the FOB export price, the year trend, and the index price for energy elasticities obtained from the CIF price linkage equations. The new tables will be analyzed separately. More important regions will be emphasized during the discussion.

Total market demand

Table 5.26 presents two sets of results, one for total market demands and one for export supply equations. Total market demand measures the demand of a single region for fresh oranges. The variables considered in the estimation of this section of the model are the average market price, real GDP, population, and substitute product price. The results are presented in a matrix where the columns represent the regions and the rows the different variables included in the model.

The economic expectations about the sign and magnitude of the different elasticities vary depending on the variable analyzed. Based on economic theory, the sign for the average market price elasticities is expected to be negative; i.e., as the average market price for fresh oranges goes up, it is expected that their consumption decreases. On the other hand, the signs for income, population, and substitute product price elasticities are expected to be positive. Consumption of fresh oranges is expected to increase as disposable income and the number of consumers in

Table 5.26 Market Demand and Export Supply Equations Elasticities.

REGION	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
					"MARKET DEMANDS"						
"MARKET PRICE ELASTICITIES"											
FV[a]	-2.182	-0.560	-0.057	-0.741	-1.182	-1.020	-1.130	-0.250	0.101	-1.052	-1.210
TS[b]	-7.020	-1.220	-0.121	-1.020	-2.255	-1.023	-1.402	-0.270	2.000	-2.000	-2.107
"INCOME ELASTICITIES"											
FV	-0.340	0.063	0.001	-0.041	0.074	-0.010	0.411	-0.002	0.151	-0.222	1.170
TS	-1.222	1.700	0.407	-0.700	1.230	-0.030	2.020	-0.310	0.740	-0.027	2.127
"POPULATION ELASTICITIES"											
FV	2.110	-1.702	1.044	7.170	-0.114	-0.727	-0.234	0.283	1.440	-0.427	0.502
TS	2.740	-1.440	2.110	1.452	-1.726	-0.340	-0.002	1.205	2.550	-0.447	0.127
"SUBSTITUTE PRODUCT PRICE ELASTICITIES"											
FV	0.640	0.020	0.134	-0.200	0.250	0.124	-0.470	0.007	-0.102	0.192	-0.523
TS	3.420	0.117	0.530	-0.421	0.020	0.422	-1.042	0.220	-2.252	1.001	-1.040
					"EXPORT SUPPLIES"						
"FOB EXPORT PRICE ELASTICITIES"											
FV	-1.070	2.242	-0.155	-0.008	-0.275	-2.550	1.424	-0.101	-1.244	-2.201	-1.702
TS	-1.010	2.042	-0.264	-0.031	-0.107	-4.163	3.217	-0.200	-2.002	-2.402	-1.220
"FRESH PRODUCTION ELASTICITIES"											
FV	0.014	1.000[c]	0.030	0.646	0.092	1.000[c]	1.107	0.357	0.154	0.303	2.144
TS	1.002	0.000	1.070	2.755	2.300	0.000	2.704	1.002	0.250	0.320	0.720

[a]Parameter values

[b]t Statistic.

[c]Canada and rest of Western Europe are not orange producers.

the region increase. The consumption of fresh oranges is also expected to increase as the prices of substitute products like bananas and apples go up.

Price elasticities are negative except for the total market demand in the Far East. The Far East is a fast-growing market (see Figure 5.9) with a lot of interest in high-quality fruit. This is especially true for Japan. Most fruit consumed in these markets come from local production. However, 80% of their imports are high-grade fruit from the United States. These conditions of the market and the characteristics of the consumers in this part of the world may partially explain why the price elasticity could be positive.

The absolute value of the "t" statistics for the price elasticities are greater than one except for Latin America and rest of Africa. Based on the characteristics of production, exports, and consumption in these two regions, consumption is probably marginal and highly driven by how much fruit is processed and/or exported. The price level under these circumstances is probably not very important since marginal fruit has to be consumed anyway. Market price elasticities are elastic (greater than one in absolute value) except for Canada and Mediterranean-EC. This indicates that the demand for fresh oranges in most regions is highly responsive to changes in the market price. Even though Canada and Mediterranean-EC have elasticities lower than one, they are between .57 and .78 which are relatively high numbers.

Income elasticities are reported in the second row. Six out of 11 regions have the correct positive sign. Positive income elasticities for Canada, EC, Middle East/North Africa, and Communist Bloc are significant.

The Far East and Latin America have positive income elasticities, but the "t" statistics indicate that they are not significant.

The rest of the regions have negative income elasticities, which is an unexpected result. The result could be related to trending population and income which implies high potential correlation between the two variables. However, only one of the negative elasticities is significantly different from zero in terms of the "t" statistic. That is the case for the United States. The "t" statistic for the income elasticity is far below the other "t" statistics obtained for the rest of the variables included in the total market demand equation for the United States. This condition indicates that the income elasticity is less significant than the rest of the parameters in the model. Income elasticities for Latin America and the rest of Africa are not significant. Demand in these regions is marginal, and apparently income does not seem to be a major demand driver.

Positive and significant income elasticities are less than one with the exception of the Communist Bloc. That is, income elasticities are inelastic (smaller than one in absolute value) in most cases. Communist Bloc income elasticity is slightly greater than one. Given the usual market controls of centrally planned economies, a slightly elastic income elasticity may be expected. Consumers in this region will buy fresh fruits and, in particular, fresh oranges in larger proportions than changes in their income whenever they have the opportunity. Also, reported import value is less likely to be reflected in consumer prices because of price controls.

Population elasticities are reported in the third row. Six out of 11 regions have the correct positive elasticities. The United States, Latin America, Mediterranean-EC, rest of Africa, and the Far East have positive and significant population elasticities. The Communist Bloc has a positive population elasticity, but it is not significant. The discussion maintained above regarding Latin America and rest of Africa is again confirmed with the results obtained. Population, and not price and income, is the major driver of the marginal demands in these regions. Price and income elasticities are insignificant for these regions.

The rest of the regions have negative population elasticities but only the ones from Canada and the EC are apparently significantly different from zero. This is an unexpected result, which implies that as population increases, consumption of fresh oranges decreases. Unexpected signs may be resulting from data or specification errors that are more likely to occur in large models as used in this study.

The magnitudes of positive population elasticities range from .56 for the rest of Africa to 7.2 for Mediterranean-EC. The rest of them are between one and 2.12. The results indicate highly elastic population elasticities in most cases.

Substitute product price elasticities are shown in row four. Seven out of the 11 regions have the correct positive elasticities, but only United States and Oceania are significantly different from zero indicating inelastic substitute product price elasticities. Consumption of fresh oranges increases less then proportionally to increases in the price index

used for bananas and apples. A recent study of the U.S. apple industry also failed to find any substitution between apples and oranges (Ward, 1991).

Four regions have negative substitute product price elasticities. Three of them have significant parameters. These regions are Middle East/North Africa, Far East, and Communist Bloc. A negative substitute product price indicates that, as the price index for bananas and apples go down (up), the consumption for fresh oranges go up (down). This is an unexpected result, which implies complementarity instead of substitutability. It can be argued that, for Middle East/North Africa and Communist Bloc, bananas and apples are not the best substitute products for fresh oranges. These substitutes were selected from models in the literature that were mainly applied to developed markets. In the Far East the substitution may exist, but given the market characteristics and consumption patterns mentioned above, the results are not as expected.

The rest of the regions with positive or negative substitute product price elasticities are not significant. This suggests that the price index for bananas and apples has little effect on the demand for fresh oranges in those regions.

<u>Export supply</u>

Export supply equations are also presented in Table 5.26. The columns show the regions. The rows show the two variables included in the estimation. The variables included in the export supply equations are FOB export price and fresh production. The first part of the following

discussion will cover general issues about the results; subsequently, the major exporting regions will be addressed separately.

Economic expectations about the sign and magnitude of the different elasticities vary depending on the variable analyzed. Based on economic theory, the sign for the FOB export price elasticities is expected to be positive. If the FOB export price for fresh oranges in a given region increases, it is expected that exports from that region increase. Fresh production elasticities are expected to be positive. If fresh production goes up, it is expected that exports go up.

Two positive FOB export price elasticities were obtained, one for the Middle East/North Africa, which is a major net exporter, and one for Canada, which is a net importer. The rest of the regions have negative FOB export price elasticities. The elasticity obtained for the Middle East/North Africa is 1.42. This indicates that FOB export price for this region is highly elastic. A change in the FOB export price will generate a larger-than-proportional change in fresh export supply.

Out of the nine regions with negative elasticities, there are five with significant parameters, three of them with strong ones. However, the regions with strong negative signs are not major exporters. Rest of Western Europe and Far East are net importers. Oceania exports represented only .5% of total world exports. The results indicate that the FOB export price is not a major factor for world fresh supply.

Fresh production is the major driver of exports. Two regions, Canada and rest of Western Europe, have zero parameters indicating that these regions have zero local fresh production. The rest of the regions have correct positive fresh production elasticities. Seven out of nine

have significant parameters. The two regions with insignificant parameters are the Far East, which is a net importer, and Oceania, which is a minor exporter.

The results show that the export supply behavior for major world exporters is good. Mediterranean-EC, with exports accounting for 44% of total world exports, has a well-behaved export supply equation with insignificant FOB export price elasticity but a strong positive fresh production elasticity. The Middle East/North Africa, accounting for 35% of total world exports, has a well-behaved export supply equation with strong positive FOB export price and fresh production elasticities. The United States and Latin America, accounting for 12.8% of total world exports, have well-behaved export supply equations. Both regions have strong positive fresh production elasticities. The United States has negative but weak FOB export price elasticity, and Latin America's price elasticity is insignificant.

Product demand

In previous sections, most of the equations were analyzed graphically and in terms of fit, performance, and simulation ability. In order to avoid unnecessary repetition, the emphasis of the following discussion will be on important trade flows. The fresh orange trade model developed here is basically interested in understanding the demand factors that make regions shift their imports from one source to another. Decisions about relevance have to be made first by selecting major world importers and then by identifying their major suppliers. Relevant regions

Table 5.27 Product Demands Relativa Price Elasticities[a]

	Region i[b]										
REGION j[b]	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
US		-0 107[c]	1 023		-4.000	-0.070	-1.103	-1 010	0.170	-1 231	-0 110
		-0.474[d]	1.756		-3.072	-2.727	-1.715	-1.035	1.007	-1.150	-1.041
CAN	1.430		-2 101		-1 010				-2.040		
	1.101		-1.033		-0.172				-1 010		
LA	1.011	-0.470		1.777	0.109	-0 013	1 007	-3 860	-3 117	1 070	-3 402
	2 040	-0.280		0.107	0.101	-1.174	0.711	-1 013	-3 700	1 300	-1 200
MED-EC	-0.017	3.007	-2 047		0.751	-2 700	0.202	-0 307	0 410	1 080	0 143
	-0 102	1.323	-0 783		0.034	-2.144	0.171	-0 301	0 530	2 470	0.173
EC	-1.114	-1.564	-0 166	-4 717		-2 054	-2.020	0 166	-3 013		-2 190
	-1 114	-1.771	-0 077	-4 621		-7.074	-1.004	0 140	-2.100		-1.410
RWE				-0.771	-2.201		-0.017		1 401		-0 333
				-1 193	-2 001		-0 501		1 656		-0 280
ME/NA	-1.104	-0.101	-1 068	-0 000	1.600	-1.000		0 054	-0 782	-0.160	-1 146
	-1 404	-0 160	-1.093	-1 022	1 107	-1.200		1.700	-1.011	-1.710	-4 171
RAF		0 366			-0 712	0.622	-1 071		-2 027		
		0 474			-1 310	1 111	-0 200		-1.077		
FE	7.110	-0 024			4 101	-0.714	-0 070	-1.400		-1.400	0.172
	4.201	-3 171			1 011	-0 411	-1.431	-4.371		-0.317	1 412
OCE	-1.111	-1.140			1 001	1 702	-1 450	-5 710	-0.221		
	-2 082	-2 014			1 910	1 110	-1.001	-4 700	-0.240		
COMMB			1 073		-0 150	5.300	-3.702		-0 400		
			0.170		-3 010	3 243	-2 010		-0.414		

[a]Product demand equals X_{ij} and relative price equals P_{ij}/P_i.
[b]Region i across the top is the region importing from region j down the column.
[c]The first line in each region represents parameter values
[d]The second line in each region represents the t Statistic.

Table 5.28 Product Demands Total Market Demand Elasticities[a]

REGION j[b]	Region i[b]: US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMM
US		1.372[c]	-1.060		-3.010	-10.050	1.111	-3.544	2.060	2.861	0.484
		1.223[d]	-1.480		-1.114	-2.041	0.010	-1.267	10.481	1.782	0.200
CAN	-5.097		0.634		-3.056				3.963		
	-0.080		0.230		-0.496				1.181		
LA	3.160	-10.171		0.210	3.025	1.200	0.740	0.105	3.111	-4.117	1.171
	1.184	-1.400		1.062	1.071	1.091	1.704	0.007	1.184	-1.850	1.600
MED-EC	37.311	-13.710	5.090		1.040	1.012	3.855	5.030	1.011	1.072	0.280
	2.174	-1.260	1.118		1.070	2.070	1.440	3.010	2.411	1.021	1.371
EC	0.015	13.210	1.490	11.140		2.080	2.570	1.001	4.984		0.825
	0.171	1.332	1.087	3.140		2.454	1.071	1.007	2.074		1.874
RWE				12.001	-1.020		1.560		-1.011		4.159
				1.180	-2.101		1.400		-2.180		1.591
ME/NA	11.093	-4.531	-3.701	1.301	0.144	0.111		0.111	-0.020	-11.470	1.117
	1.011	-1.111	-0.648	0.780	0.147	0.480		0.490	-0.050	-3.414	4.177
RAF		-1.011			-0.041	0.762	1.961		2.680		
		-1.004			-0.080	1.182	4.030		0.031		
FE	0.170	3.107			13.101	-4.110	3.304	-0.081		1.104	7.047
	0.177	4.017			1.721	-0.417	3.600	-2.420		0.112	1.011
OCE	30.080	14.113			10.071	7.410	4.741	-1.176	1.130		
	3.151	3.740			1.420	2.263	0.670	-0.196	1.890		
COMM			13.013		12.680	-1.072	6.263		0.271		
			1.128		1.101	-0.640	1.117		1.701		

[a]Product demand equals X_{ij} and total market demand equals X_i.
[b]Region i across the top is the region importing from region j down the column.
[c]The first line in each region represents parameter values
[d]The second line in each region represents the t Statistic.

will be addressed separately and both relative price and total market demand variables will be analyzed in each case. Latin America, Mediterranean-EC, rest of Africa, and Oceania are net exporters; their imports represented only .5% of total world imports during the 21-year period considered. These regions will be analyzed briefly following the discussion about leading importers.

Tables 5.27 and 5.28 show the estimated parameters and their associated "t" statistics for the product demands. Product demands measure the demand in a given region for fresh oranges coming from another region. There will be one product demand in each region for each one of the partner regions. Since the model has a total of 11 regions, the number of estimated product demands should be 110 (11 regions with ten partners each).

The variables considered in the estimation of this section of the model are relative price and total market demand. The relative price variable refers to the price of the imported product (for example, the price of fresh oranges from Latin America in the EC) relative to the average market price (in the EC). If the relative price variable increases, imported product price is going up faster than the average market price. In that case, demand for that product should decrease in the final market. This example implies that the exporting region will be losing part of its market share in the final market. Therefore, the expected sign for relative price elasticities is negative.

The other variable included in the model is total market demand. This variable measures apparent consumption or total size of the market for fresh oranges in a given region. If market size increases

(decreases), it is possible that a given product demand could increase or decrease. The resultant sign will depend on consumer preference about where to buy their product when the size of the market is increasing or decreasing. For example, if total market size is growing, the demand increase could be satisfied by increasing local product consumption or by shifting between any of the ten supplying regions. Therefore, the expected sign could be positive or negative.

Tables 5.27 and 5.28 have the same structure. The results are presented in a matrix where both columns and rows represent regions. The columns represent the final market region or importer and the rows the partner regions or exporters. For example, the second column represents Canadian imports. The first entry (second column first row) is the result for the relative price elasticity of the Canadian demand for United States fresh oranges (product). Some of the product demand equations were not estimated, given insufficient trade between some regions. Therefore, some table cells are empty.

Table 5.27 present a total of 82 estimated relative price elasticities. Fifty five of them show the correct negative sign. The remaining 27 are positive, but ten of them are not significant. Table 5.28 shows the results for the total market demand elasticities. Signs are mixed as expected, and 62 of the 82 estimates are significantly different from zero.

<u>United States</u>. United States imports represented 1.2% of total world imports during the 21-year period studied. Major imports to the United States came from Latin America, Middle East/North Africa, and Mediterranean-EC. The parameter for Latin America is positive and

significant. Given the results in terms of fit and performance discussed above, this is an unexpected result. Given the large production capacity of the United States and that imports from Latin America represent only 2.6% of U.S. total market demand, possibly imports are occurring only when domestic production is insufficient to supply the fresh market. The results show that the parameters are negative for the Middle East/North Africa and Mediterranean-EC. However, the parameter is not significant for the Mediterranean-EC. The parameter for the Middle East/North Africa product is -5.56, which indicates a highly elastic relative price elasticity. A small change in relative prices will have an important effect in the demand for the product.

Total market demand elasticities for United States' three major partners are positive, highly elastic, and significant. Elasticities are 3.3 for Latin America, 11.7 for Middle East/North Africa, and 27.3 for Mediterranean-EC. Results indicate that the demand for the product of these regions in the United States is very sensitive to changes in the size of the market. Therefore, a small increase in the United States total market demand results in a large increase in the demand for the different products. Given the differences in elasticity magnitudes, any change in the United States market size implies a different change for each product demand. Mediterranean-EC product demand will change faster than demands for Latin America and Middle East/North Africa products in the United States.

Canada. Canada imports represented 4.8% of total world imports in the period studied. Relevant Canadian partners are the United States, Far East, and Middle East/North Africa. Relative price elasticities for these

regions are negative. However, only one is highly significant. This is the case for the Far East product. The magnitudes in the three cases indicates that relative price elasticities for this region are inelastic. An increase in the relative import price implies a less than proportional decrease in demand for the product.

To understand some of the implication of the empirical results, an example will be developed. Suppose that there is no local production and that only two suppliers exist for Canada: the Far East (-.92) and Oceania (-2.55) (see Table 5.27). The elasticities obtained imply that an equal change in the relative price variables will have different effects in each product demand. A similar increase in relative prices will cause a shift from consuming Oceania product to consuming relatively more product from the Far East.

Total market demand elasticities for Canada's three major partners are elastic and significant. The elasticity for the Middle East/North Africa product is negative, while the ones for the United States and the Far East are positive. The magnitudes of these elasticities indicate that the demand for these products in Canada is highly sensitive to small changes in the size of the market. The direction of change for the Middle East/North Africa is different from the other regions. For example, if Canadian market size grows consumers will shift from Middle East/North Africa product to the United States or Far East products.

<u>EC</u>. EC imports represented 63.4% of total world imports in the 21-year period studied. Major EC partners are Mediterranean-EC, Middle East/North Africa, rest of Africa, Latin America, and United States. Product demands for the United States and rest of Africa have significant

negative elasticities The magnitudes for the rest of Africa and the United States indicate an inelastic relative price elasticity for the rest of Africa and an elastic one for the United States in the EC.

The other three regions have positive elasticities but only the one from the Middle East/North Africa is significant. EC's major partner has been Mediterranean-EC. This partnership has been growing fast and trade has been shifting from the Middle East/North Africa to the Mediterranean-EC through the years. It is possible to argue that EC imports from the Middle East/North Africa are marginal in the sense that they are needed only to complement fruit purchases from Mediterranean-EC. This suggests that the fruit is imported when prices are going up due to the lack of sufficient fruit in the market. This conclusion could partially explain the positive sign, but is truly a conjecture not based on actual data.

Total market demand elasticities for three of EC's five major partners are elastic and significant. United States product elasticity is -3.94; Latin America is 2.63; and Mediterranean-EC is 1.85. Middle East/North Africa and rest of Africa have insignificant parameters. The magnitudes of significant elasticities indicate that demand for the product of the United States, Latin America, and Mediterranean-EC in the EC is very sensitive to changes in the size of the market. However, as in the Canadian case, the direction and magnitude of change are different for each partner region. For example, if EC's market size grows, consumers will shift from United States product to the Mediterranean-EC or Latin America products.

<u>Rest of Western Europe</u>. Rest of Western Europe imports represented 10.6% of total world imports in the period studied. Major partners are

Middle East/North Africa, Mediterranean-EC, and rest of Africa. The results indicate that two of the three relative price elasticities are negative and significant. Rest of Africa shows a positive elasticity, but the "t" statistic is low and therefore not significant. Middle East/North Africa and Mediterranean-EC elasticities are elastic. Product demands are highly sensitive to changes in relative prices. The same is true for relatively smaller partners such as Latin America and the United States.

Total market demand elasticities for rest of Western Europe's three major partners are positive, and two of them are significant. The magnitudes show an elastic total market demand elasticity for Mediterranean-EC and an inelastic one for the rest of Africa. Results imply that, if market size grows the demand for Mediterranean-EC product will grow in a higher proportion than the demand for rest of Africa product. Middle East/North Africa total market demand elasticity is not significantly different from zero.

Middle East/North Africa. Middle East/North Africa is a net exporting region; however, imports have been growing fast lately and represented 1.65% of total world imports during the 21-year period. Major partners are Far East, rest of Africa, Latin America, Mediterranean-EC, and Oceania. Three of the five product demands have negative relative price elasticities, two of which are significant. Negative and significant elasticities were obtained by product demands from the Far East and Oceania. The rest of Africa has a negative but insignificant elasticity. Latin America and Mediterranean-EC have positive elasticities, but they are also not significant. The results show that the elasticity for the Far East is inelastic, while that for Oceania is

elastic. Other smaller partners have product demand elasticities which are negative, highly elastic, and significantly different from zero in this region.

Total market demand elasticities for Middle East/North Africa's five major partners are positive, highly elastic, and significant. Elasticities are 6.75 for Latin America, 3.65 for Mediterranean EC, 5.61 for rest of Africa, 3.29 for Far East, and 4.74 for Oceania. The magnitudes indicate that product demands are highly sensitive to change in the size of the market. Figure 5.7 implies a fast-growing tendency for this market in the last few years. Given the results, Middle East/North Africa have apparently been willing to import whatever is necessary to supply their needs. Given that this region is a net exporter it is also possible that part of the imported fruit had been used for reexports and/or processing. The differences in magnitudes imply that consumers would prefer to import certain products before others while supplies last.

Far East. Far East imports represented 4.3% of total world imports in the period studied. Major Far East partners are the United States, Middle East/North Africa, Oceania, and rest of Africa. Three of the product demands have negative relative price elasticities, two of which are significant. Negative and significant elasticities were obtained for the Middle East/North Africa and the rest of Africa. The first one is inelastic and the second one elastic. Oceania has a negative and inelastic elasticity, but it is not significantly different from zero. United States product demand shows a positive relative price elasticity This would indicate that consumers in the Far East are willing to consume more from the United States, even when its relative price is going up.

This result confirms the discussion maintained in previous sections about the characteristics of the markets and consumers in the Far East with regards to fast growth and interest in quality and high-grade fruit. This is especially true for trade between the United States and the Far East markets.

Total market demand elasticities for Far East's four major partners are positive except for the case of the Middle East/North Africa. Elasticities are 2.66 for the United States, 2.69 for the rest of Africa, and 1.3 for Oceania. Middle East/North Africa elasticity is negative but not significantly different from zero. Elasticity magnitudes indicate that product demands from the different sources are very sensitive to changes in the size of the market. Since the Far East market has been growing fast in the last 21 years, shifts from one region to another are common and will probably continue in the future.

<u>Communist Bloc</u>. The Communist Bloc imports represented 13.6% of the world's total imports in the period considered. Major partners are Middle East/North Africa, Mediterranean-EC, and Latin America. Two of them have significant negative relative price elasticities. Mediterranean-EC has a positive but not significant elasticity. Middle East/North Africa and Latin America results show product demands with highly elastic relative price elasticities.

Total market demand elasticities for Communist Bloc's three major partners are positive and significant. Elasticities are 3.38 for Latin America, .28 for Mediterranean-EC, and 1.24 for the Middle East/North Africa. The results show an elastic response with respect to total market demand for Latin America and Middle East/North Africa products and an

inelastic one for Mediterranean-EC. Given an increase in the Communist Bloc market size, consumers will consume relatively more from Latin America and the Middle East/North Africa than from Mediterranean-EC.

Latin America, Mediterranean-EC, rest of Africa, and Oceania. Latin America, Mediterranean-EC, rest of Africa, and Oceania are net exporters. Their imports represented only .5% of total world imports during the 21-year period considered. Latin America major partners are the United States and EC. The results for relative price elasticities indicate that in Latin America the product demand for the United States has a positive elasticity and, for the EC is negative but not significant.

Mediterranean-EC major partners are Latin America, EC, and Middle East/North Africa. Demands for EC and Middle East/North Africa products have negative and significant elasticities. Relative price elasticity for Latin America product demand is positive but not significant.

Rest of Africa major partners are EC, Middle East/North Africa, and Oceania. Elasticities for EC and Middle East/North Africa products are positive. However, the elasticity from the EC is not significant. The demand for the Oceania product is negative and significant.

Oceania major partners are the United States, Latin America, and the Middle East/North Africa. Elasticities for the United States and Middle East/North Africa products are negative and significant. Latin America product has a positive and significant elasticity.

Relative price elasticities turned out to be positive and significant in three cases. They are the demands for United States product in Latin America, Middle East/North Africa product in rest of Africa, and Latin America product in Oceania. As mentioned before, for

Latin America and rest of Africa it can be argued that imports are required only on special occasions, probably related to insufficient local production or high quality needs. These conditions may partially explain the positive signs. Given the number of observations for the Latin America product demand in Oceania, the results in this case are probably related to insufficient information.

Total market demand elasticities for low import regions indicate that, in most cases, the parameters are significant. The exceptions are for Middle East/North Africa and Oceania products in the rest of Africa and for the Middle East/North Africa product in the Mediterranean-EC.

CIF price linkage equations

Tables 5.29 to 5.31 show the estimated parameters and their associated "t" statistics for CIF price linkage equations. These equations measure the linkage between the CIF (Cost-Insurance-Freight) import price in the final market and the FOB (Free-On-Board) export price in the exporting region. There will be one CIF price linkage equation in each region for each one of the partner regions. Since the model has a total of 11 regions, the number of estimated CIF price linkage equations should be 110 (11 regions with ten partners each).

The variables considered in the estimation of this section of the model are FOB export price, a year trend, and an index price for energy. The FOB export price variable refers to the Free-On-Board price in the exporting region, i.e., the price of fresh oranges in the port from which the export will be made. If the FOB export price in the exporting region increases, it is expected that the CIF import price in the final market

also increases. The magnitude of this relationship is expected to be one in the ideal case. That will be the event when there are no transportation costs to be added or other external factors which affect the relationship. This is obviously not the case for the fresh orange trade model developed here. However, the results are expected to be close to one and have a positive sign.

The year trend variable was included in the model to capture structural changes in the industry and the transportation-system. These exogenous effects are not expected to be predicted by other variables in the model. The sign of this variable could be positive or negative, depending on the type of structural change occurring between two trading regions.

The index price for energy was included in the model to capture changes in transportation costs due to changes in the world price of oil. Since transportation cost is expected to increase (decrease) with increases (decreases) in the price of oil, then the expected sign is positive.

Tables 5.29 to 5.31 have the same structure. The results are presented in a matrix where both columns and rows represent regions. The columns represent the final market region or importer and the rows the partner regions or exporters. Some CIF price linkage equations were not estimated, given insufficient trade between some regions. Therefore, some entries are empty.

The discussion about the CIF price linkage equations will be developed in general terms, i.e., the regions will not be addressed on a one-by-one basis. The reason for this approach is that, in general, the

Table 5.29 CIF Price Linkage FOB Export Price Elasticities[a]

	Region i[b]										
REGION j[b]	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAP	FE	OCE	COMMB
US		0.215[c] 0.275[d]	2.080 3.241		0.550 2.103	0.032 2.585	0.803 2.014	1.035 3.480	0.702 2.580	0.050 3.572	1.244 3.513
CAN	0.590 2.271		0.080 2.510		1.021 2.103				0.702 4.203		
LA	1.008 2.265	0.108 0.418		0.080 0.103	0.210 0.085	0.040 0.105	0.730 2.010	1.020 7.011	0.057 2.535	0.208 0.080	1.505 5.038
MED-EC	0.084 2.804	0.050 2.508	0.720 2.151		1.085 7.241	0.083 7.095	0.788 1.035	0.130 0.283	0.017 2.207	0.131 0.200	1.247 6.517
EC	0.087 4.720	0.085 2.008	0.075 3.025	0.222 0.420		1.301 4.365	0.872 2.005	1.087 5.700	0.085 2.735		1.310 2.003
RWE				1.088 5.210	1.274 5.570		1.107 2.414		0.725 2.025		1.100 2.040
ME/NA	0.738 2.223	0.031 2.004	0.848 1.214	1.192 2.080	1.003 4.557	1.074 0.150		0.570 2.080	2.523 0.333	0.010 2.125	1.057 5.342
RAP		1.058 2.103			0.578 2.523	0.850 4.807	0.433 2.450		0.800 1.581		
FE	1.131 3.250	0.080 2.085			0.035 3.815	0.031 2.054	1.243 5.407	1.590 2.780		0.807 1.054	1.380 5.030
OCE	1.001 2.042	0.303 0.023			0.900 2.205	0.044 2.627	1.004 2.147	1.230 3.540	0.408 2.558		
COMMB			0.408 0.041		0.805 3.071	0.608 3.820	1.407 2.347		0.012 2.512		

[a] CIF price linkage equals C_{ij} and FOB export price equals θ_{ij}

[b] Region i across the top is the region importing from region j down the column

[c] The first line in each region represents parameter values.

[d] The second line in each region represents the t statistic.

Table 5.30 CIF Price Linkage Year Trend Elasticity[a]

	Region i[b]										
REGION j[b]	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMME
US		5.402[c]	-0.093		0.500	0.014	0.035	0.470	0.084	1.280	-1.080
		0.000[d]	-1.452		0.205	0.000	0.005	0.108	0.080	1.042	-0.421
CAN	4.140		-2.441		-1.187				-2.603		
	1.170		-0.550		-0.380				-0.800		
LA	-4.570	3.002		5.840	1.187	3.080	0.507	0.715	1.280	0.470	-2.080
	-2.110	1.007		1.034	0.730	2.584	0.217	0.424	0.583	0.201	-1.180
MED-EC	-1.500	1.098	0.128		-1.460	1.132	-5.040	5.708	-0.880	1.520	-0.070
	-0.014	0.473	0.047		-2.100	1.001	-0.073	1.800	-0.430	0.583	-0.108
EC	-0.272	-4.010	0.775	2.425		-1.730	2.450	0.080	-2.052		0.001
	-0.111	-1.342	0.408	1.007		-1.583	0.750	0.107	-0.844		0.000
RWE				4.100	-0.405		-3.505		0.807		-1.073
				1.400	-0.300		-0.710		0.385		-0.472
ME/NA	2.405	-0.000	2.065	-0.570	0.071	1.217		2.008	-2.500	-0.720	-0.406
	1.230	-0.040	0.305	-1.380	0.052	2.010		2.073	-0.077	-0.235	-0.283
RAF		0.280			0.005	0.420	0.740		0.010		
		0.151			0.005	0.700	0.040		0.432		
FE	-0.007	0.300			-0.470	1.530	-2.223	2.007		-0.005	-3.520
	-0.050	0.150			-0.227	0.807	-0.008	0.880		-0.001	-1.450
OCE	1.740	-5.040			-0.145	-1.000	-5.070	2.251	0.753		
	0.457	-0.820			-0.103	-1.000	-1.311	1.000	0.803		
COMME			1.040		-0.682	0.827	-2.040		-0.110		
			0.443		-0.040	0.515	-0.411		-0.112		

[a]CIF price linkage equals C_{ij} and Year trend equals TRD
[b]Region i across the top is the region importing from region j down the column
[c]The first line in each region represents parameter values
[d]The second line in each region represents the t Statistic

Table 5.31 CIF Price Linkage Index Price For Energy Elasticity[a]

	Region i[b]										
REGION j[b]	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMME
US		0.010[c] 0.205[d]	-0.246 -0.020		0.120 1.557	0.123 1.700	-0.001 -0.003	-0.005 -0.307	-0.010 -0.253	-0.011 -0.200	0.050 0.407
CAN	-0.110 0.624		0.407 1.050		0.020 0.144				0.100 1.357		
LA	0.102 2.042	0.154 1.470		0.100 0.010	0.170 2.370	0.154 3.377	0.048 0.426	-0.055 -0.544	-0.005 -0.034	0.100 1.540	0.004 0.035
MED-EC	0.103 1.403	0.084 0.470	0.170 0.020		-0.011 -0.220	-0.004 -0.103	0.251 0.000	-0.110 -0.000	0.011 0.200	0.257 1.732	-0.031 -0.407
EC	0.047 0.320	0.307 2.047	0.004 0.034	0.050 0.357		-0.012 -0.120	-0.000 -0.551	-0.072 -1.312	0.123 0.052		-0.023 -0.104
RWE				-0.200 -2.155	-0.121 -0.001		0.205 0.043		-0.002 -0.014		0.170 0.750
ME/NA	0.032 0.202	0.005 0.000	0.022 0.000	0.300 1.473	-0.030 -0.407	-0.047 -1.334		-0.064 -0.052	-0.155 -1.400	0.150 0.604	-0.104 -2.455
RAF		-0.011 -4.057			0.102 1.400	0.122 2.458	0.157 1.040		0.062 0.082		
FE	-0.043 -0.070	0.003 0.037			-0.033 -0.212	-0.024 -0.126	0.164 0.075	-0.222 -1.000		0.075 0.350	0.232 1.071
OCE	-0.064 -0.254	0.270 2.922			-0.010 -0.092	0.230 2.724	0.258 1.400	-0.205 -0.040	0.112 2.510		
COMME			0.186 1.330		0.042 0.500	0.000 1.732	-0.073 -0.365		0.077 0.040		

[a]CIF price linkage equals C_{ij} and index price for energy equals PEN
[b]Region i across the top is the region importing from region j down the column.
[c]The first line in each region represents parameter values.
[d]The second line in each region represents the t Statistic.

results have similar interpretations and differ very little from the expected signs and values.

Table 5.29 presents a total of 82 estimated FOB export price elasticities. All of them are positive as expected. Seventy one are significant, 30 of them elastic and the rest inelastic. Most FOB export price elasticities are close to unity. This indicates that, for a given change in the FOB export price in the exporting region, a similar change will occur in the CIF import price in the importing region. This result was expected.

Table 5.30 shows the results for the year trend variable. Signs are mixed, as expected, and 31 of the 82 parameters are significant. All regions have at least one CIF price linkage equation with a significant parameter. It is interesting to notice that only elastic (greater than one in absolute value) positive or negative elasticities are significant. This implies that, for those CIF price linkage equations with significant parameters, the CIF prices are changing faster than the year trend. Industry and transportation-system structural change seems to be unimportant for those trading regions with insignificant parameters. This implies either that there had not been a structural change or that the change had been negligible.

Table 5.31 presents the elasticities for the index price of energy. The values obtained indicate that 49 have the correct positive sign and 33 have negative signs. However, only six of the negative elasticities are significantly different from zero. The six significant elasticities are spread among a few regions. They are rest of Western Europe product demanded in Mediterranean-EC; Middle East/North Africa product demanded in

the rest of Western Europe; EC and Far East products demanded in the rest of Africa; Middle East/North Africa product demanded in the Far East; and Middle East/North Africa product demanded in the Communist Bloc. Given that, in most cases, the relationship is strong and the rest of the model is well behaved with respect to this variable, two possible alternatives could explain this situation: a data problem, or the existence of certain structural change still not predicted by the model.

Conclusion: economic analysis

The economic analysis shows that the model results seem more satisfactory for total market demands than it does for export supply equations. In most cases the model is capturing major variations of total market demands and export supplies for leading regions in world markets. Most total market demand elasticities were between the expected signs and magnitudes and made sense in most cases. In the events where wrong elasticity signs were obtained, possible explanations were given.

The results for the export supply equations indicate that the FOB export price is apparently not a major factor for export supplies. This is an unexpected result. The other variables included in the model are reflecting most of the export supply variations. Fresh production is the strongest variable in the model. Nevertheless, export supply equations for major world exporters behaved quite well as concluded in the statistical analysis.

Once again, the results show that major trade flow equations are captured by the model in most cases. Product demand equations for the

most important trading regions have the correct signs. Magnitudes were usually in the normal ranges.

CIF price linkage equations are definitely the best behaved in every case. The equations responded correctly to the expected signs and magnitudes in almost every case.

Application for Policy Purposes

The empirical results and implications have been discussed using three complementary analyses, graphic, statistical, and economic. The general results indicate that the fresh orange trade model developed here captures the trend of all dependent variables; has a general good fit; is apparently well specified; predicts most turning points; and in a majority of cases conforms to economic expectations.

These results do not apply for every equation. However, in most cases the best behaved equations belonged to the leading regions and trade partners in the world's fresh orange industry. In any event, given the size and complexity of the model, the individual equation problems are difficult to adjust. A possible solution to obtaining better results might be accomplished by developing a different model for every equation. Given the number of equations in the model, this task was not possible given the resource constraints on this study.

The results obtained from this study have a number of policy applications, including changes in market shares, market growth, and reallocations among markets. Drawing on the empirical results, one can readily address many of the important policy questions. Rather than

dealing with all possible issues, it is probably more useful to illustrate the application of the model with specific examples. Two issues are of particular importance across every region. First, what would cause the total market demand to change, and can that change be predicted? Second, given that the market demand grows for a particular region, how will the market be supplied (i.e., who will be the exporters?) Asked another way, how will each region's share of the market growth change? In this brief section, a few examples are given showing how to address these questions.

To illustrate a selected case, suppose that the economic development in the Communist Bloc yields an increase for real income (GDP) of 5% a year in the next five years. Drawing from the results in Table 5.1, the income elasticity for total market demand in this region is 1.176. Therefore, if the income growth assumption is valid, fresh orange total market demand is expected to increase 5.88% per year, holding other variables fixed.

Next, the issue of who will supply this demand growth can be shown using the empirical results from the product demand equations. For example, from the United States perspective, what will the benefit of an increase in the Communist Bloc's total market demand to the United States? That is, will the United States share of the Communist Bloc market grow? Table 5.13 provides the Communist Bloc product demand for each region exporting to this market. The first row in this table corresponds to the United States supply. If the relative price of United States exports were held fixed and the Communist market grew by 5.88% as assumed above, then, with this equation, one would predict the United States exports to grow by 2.85% (e.g., 5.88*.484=2.85). The Far East, Latin America, and the Middle

East/North Africa will increase their exports by 46.14%, 19.85%, and 7.27% per year, respectively. In terms of the United States market share, the model would point to a decrease in the United States share since the market share elasticity in this equation is -.516 (see equations 4.25 and 4.26). Thus, for this specific example, the United States loses shares in this importing region relative to other suppliers. Clearly, other regions' shares of this market must be increasing. The Far East, Latin America, and the Middle East/North Africa will increase their market share in the same period.

Given that the United States share actually declines, the model can also be used to show how much of a price adjustment would be needed to offset the decreasing market share. These results clearly indicate that the United States must be more price competitive in this example in order to prevent an erosion in their share of this market.

Now, suppose that the population of the United States grows by 1% a year for the next five years. Table 5.1 indicates that fresh orange total market demand will increase by 2.12% a year in the same period. Table 5.3 shows the product demands' total market demand elasticities for the United States. The model predicts that Oceania, Mediterranean-EC, Middle East/North Africa, and Latin America will benefit from increases in United States total market demand holding relative prices fixed. However, Oceania and Mediterranean-EC are predicted to have the major benefits.

Suppose that world prices increase in the same proportion for all regions. What will happen with the product demands in the Communist Bloc? Table 5.1 shows that total market demand in the Communist Bloc will decrease. Table 5.13 indicates that United STates product demand in that

region will also decrease given the change in the Communist Bloc total market demand. The United States product demand will also be affected through the price changes. The final direction of the United States product demand in the Communist Bloc will depend on the specific percentage change in prices and the parameter values.

These same procedures can be applied to other total market demand and to any of the product demands. The results will differ depending on the specific elasticities for the situation being explored. Discussions and analyses similar to the previous ones can be developed for every region and partner region, and for the rest of the variables included in the model. Policy decisions can be proposed or supported by the results obtained using the model.

Conclusion

The first part of this Chaprer described the different steps followed to estimate the fresh orange trade model developed in Chapter 4 The second part presented and analyzed the empirical results and their major implications. Given the nature of the model, a NL2SLS procedure was utilized to estimate the model. The parameters obtained are consistant but biased. The empirical results and the analysis developed indicate that the model generally behaved well. Therefore, it can be used to predict changes in the world fresh orange industry given changes in the different variables.

In the next chapter a sensitivity analysis procedure will be developed. Leading world fresh orange industry participants will be evaluated under changes in the most important variables of the model.

CHAPTER 6
ECONOMIC IMPLICATIONS FROM SENSITIVITY ANALYSIS

Introduction

Two basic objectives were laid out in Chapter 1 regarding the development of the fresh orange trade model. The first objective was to develop a model to understand the major driving factors affecting world fresh orange consumption and trade. This was accomplished in the discussion in Chapter 5. The second objective was to determine what happens when variables in the model change. In other words, what are the comparative static implications of the trade model.

This chapter sets forth a sensitivity-analysis procedure to evaluate the consequences of changes in the main variables of the model. The results obtained from applying the procedure will complement the discussion of Chapter 5 and will add new insights into the behavior of the model.

In this chapter, the more important responses were illustrated by selecting the major partner regions for each region. The variables that better explain the model were also selected to be modified by the sensitivity analysis. The comparative static implications in each case were assessed. To illustrate the relative responses, scale effects were removed by indexing the variables to the base year. The chapter also provides a graphical presentation of the results, which helped to

visualize the pattern of adjustments to specific variables. It also facilitated the comparison of the responses among partner regions in each region. This comparison is not easy to see when looking only at the coefficients, especially given the size of the model and the number of parameters estimated. None of the analysis up to this point dealt with adjustments in the variables. It was mainly a discussion on the coefficients sign, magnitude, and significance. Certain variables have important policy implications that could be clarified by using the information presented here. As an example, given the characteristics of the fresh orange trade data, a range of 30% above and below the base year was considered reasonable. This gives an indication of the type of responses and their limits for the fresh orange trade model (for example, for relative prices). Much of the information in this chapter is intended to help the reader to have a better understanding of the full model faced with such a large number of coefficients or elasticities.

The chapter is divided into four sections. The first section develops and explains the procedure for the sensitivity analysis. The second discusses the rationale utilized to select the regions, equations, and variables to be analyzed. The third develops the sensitivity analysis for selected regions and equations, including a detailed discussion about the results. The fourth summarizes the major conclusions and implications of the chapter.

Sensitivity Analysis Procedure

The fresh orange trade model developed is a nonlinear simultaneous system of equations. If the reduced form of the model can be obtained, the model can be simulated as a whole for changes in the different exogenous variables. The reduced form of a simultaneous system of equations is obtained when all equations are expressed with only exogenous variables in the right-hand side. This approach implies that, for a given change in any exogenous variable, it is possible to assess the impact in all 561 endogenous variables. A change in any exogenous variable produces changes in all equations. The impact comes first from the exogenous variable itself, and then from all the endogenous variables that will be affected through the different equations. Given the size and complexity of the model, the reduced-form parameters are difficult to obtain; and it is not assured that they can be found. For the fresh orange trade model presented in this study, it was not possible to solve for the reduced form parameters. However, it was possible to perform a comparative static analysis equation by equation.

Sensitivity analysis can be conducted to investigate the effects of changes in the different variables of the model. It is possible to assess the impact on any dependent variable, using the estimated parameters and introducing changes in selected variables. This approach implies that the analysis will not take into consideration the rest of the model when a variable is changed and the impact on a given equation evaluated. However, the estimation procedure does take into consideration the rest of the model and its nonlinear and simultaneous characteristics.

The procedure developed works on an equation by equation basis. Every equation has endogenous and exogenous variables in the right-hand side. Therefore, the variables to be changed in the sensitivity analysis could be exogenous or endogenous. Given that four different types of equations were estimated, the variables to be changed will vary depending on the type of equation analyzed. A total of 242 equations were estimated using a simultaneous system approach. Each region has one total market demand, one export supply, and ten product demands and CIF price linkage equations. The main objective of the sensitivity analysis was to evaluate the impact on the dependent variable of a given equation for a given change in one of the right-hand side variables.

Sensitivity analyses can be developed following different approaches. The procedure has to provide the necessary tools to address the important questions. In the fresh orange trade model, a major issue of interest is to compare the behavior of the different regions under different scenarios. Since consumption and trade volumes differ dramatically among regions, to facilitate the analysis and its interpretation, a common framework has to be built. One way to overcome the problem is to develop an index number common to all regions through which they can be compared.

The index chosen for the present study is based on a starting year. The changes in the variables will depart from the base year and the results will be evaluated and compared for the different regions. The decision about the base year depends on the type of questions to be addressed. As mentioned above, the objective of sensitivity analysis was to forecast changes in the dependent variables given changes in the

different right-hand side variables. The last observation of the original data set is 1986. Using 1986 as the base year, departures from 1986 provide simulated values in response to specific variable levels.

The procedure and the computer program used for the sensitivity analysis is included in Appendix I. The first temporary data set was developed that included seven simulated values for all of the original variables at the 1986 level. All observations had exactly the same values, i.e., 1986 values. The temporary data set was then modified by using a step procedure that affected each observation. The temporary data set was multiplied by a vector containing .7, .8, .9, 1, 1.1, 1.2, and 1.3, thus giving a completely new data set with seven simulated values expressed as some percentage of the base. The observations of the new data set ranged from 30% below the 1986 values in the first observation to 30% above the 1986 values for the seventh observation. Thirty percent above and below the 1986 values was selected considering that bigger percentage changes were unlikely to have occurred. See Sparks (1987) for another application of this simulation approach.

Two additional data sets were needed to complete the sensitivity analysis: the original data set with 1986 values, and a new data set containing the values of all the estimated parameters of the model.

Since the estimated model equations were given in the log form, it was necessary to reexpress all the equations in exponential form. The equations have dependent variables no longer in the log form in the left-hand side and exponential equations on the right-hand side. The right side of the equations included the estimated parameters and the right-hand side variables (see Appendix I). The specific values to substitute for

the right-hand side variables were obtained from the simulated data sets. In order to compare the changes in the dependent variables, only one right-hand side variable was modified at a time. The rest of the variables remained at their original 1986 values.

The substitution of the new data sets into the equations generated seven new dependent variable values, one for each percentage adjustment to the base. The new simulated dependent variable values were indexed to the 1986 base value. The index helped to show the implications from changes in the right-hand side variables in the different equations and markets. It also helped to compare the results among the different regions. If the index number was one, then the new dependent variable value was equal to the 1986 value. If the index number was above or below one, the simulated value was above or below the 1986 value, respectively.

The sensitivity analysis and resulting responses can be illustrated with figures that show the behavior of the different dependent variables, given changes in the right-hand side variable. The graphical approach provides a useful interesting framework to illustrate the impact of changes in the different equations and markets and to compare the results among regions.

For example, Figure 6.1 shows the total market demand for major world consumers. Total market demands are functions of average market price, income (GDP), population, and substitute product price. The average market price is one of the right-hand side variables. The figure shows an index number ranging from .7 to 1.3 for the average market price on the bottom axis. That is, the average market price has been modified from 30% below to 30% above the 1986 price level. The left axis shows an

index number for total market demand. The simulated or new total market demand values are obtained by substituting the modified average market prices into the original equation while holding all other variable values fixed at the 1986 levels. The exact index on the left axis will depend on the simulated values actually obtained, given the step-wise changes in the average market price.

Rationale for Region, Equation, and Variable Selections

The analysis of the fresh orange industry shows that total consumption, imports, and exports are concentrated in a few regions. Some regions are major consumers, others major importers or exporters, and most regions have a small set of important trade partners. Considering these conditions, it is reasonable to select a subset of regions on which to perform the sensitivity analysis in each event. In most cases, a few regions will represent over 90% of total world consumption or exports, and a few regions will also account for over 90% of total supply. Applying the sensitivity analysis to all 262 estimated equations will provide little additional information since many relationships will have almost no impact on the major factors affecting the world fresh orange industry

Total market demand equations represent total consumption or demand for fresh oranges in a given region. The model developed considers both total domestic consumption and total trade. Therefore, total demand and total imports per region relative to the rest of the world should be considered to select the more important regions. Given that a small group of regions represented major world consumers and another small but

different group represented major world importers, two groups were selected for the total market demand analysis. This implies that two sets of figures will be included in the sensitivity analysis, one set for major world consumers and another set of figures for major world importers.

The selection of regions for the export supply analysis was based on major world exporters. Total exports per region relative to the rest of the world were considered to select the relevant regions. Given that a small group of regions represented most of the world exports, one set of figures will be presented in this case.

The selection of partner regions for the product demands and CIF price linkage equations was based on relative volumes supplied by each partner region. The volumes were accumulated, and at least 90% of total supply had to be accounted for, to decide which regions to include. Each region had a different set of partners, depending on its major trade flows.

The final objective of any simulations or sensitivity analysis is to find out what are the forecasted values of the main variables. The main variables for the fresh orange trade model are total market demands, export supplies, and product demands for important regions. Most intermediate variables and equations in the model will change, given changes in the right-hand side variables. However, the final impact on the main variables of the model is the important issue.

CIF price linkage equations were developed to capture the linkage between the FOB export price in supplying regions and the CIF import price in the final markets. These equations were not considered in the sensitivity analysis. Import prices in the final market were assumed to

be known and were changed from approximately 30% below to 30% above 1986 levels. It is also possible to determine what the necessary change in the FOB export price, tariff, tax, or any other factor would be when the final market import price changes over the proposed range. To perform this analysis, the respective CIF price linkage equation and some of the model identities had to be used. These questions are important, but they can always be addressed at a later step considering the results and the specific regions of interest. Therefore, the equations selected for the sensitivity analysis were total market demands, export supplies, and product demands.

Each equation selected is a function of a different set of variables. A decision had to be made regarding the set of variables to be modified for each equation. Total market demands are functions of average market price, income (GDP), population, and substitute product price. Changes in the average market price are related to changes in tariffs, taxes, local prices, and FOB export and CIF import prices. Economic theory and the empirical results of Chapter 5 indicate that average market price and income (GDP) are the major driving factors for consumption in most regions. Therefore, these variables were included in the sensitivity analysis for total market demand equations.

Export supply equations are functions of the FOB average export price and domestic fresh production. The empirical results of Chapter 5 indicate that fresh production is probably the major driving factor for exports. However, economic theory suggests that FOB average export price should also be a major factor. Given these conditions, both variables were included in the analysis.

Product demand equations were defined as functions of the relative price and total market demand. Relative price variables refer to the import price of a product coming from a certain region relative to the final market average price. The import price could change relative to the final market average price, due to changes in tariffs, taxes, FOB export prices, other factors included in the CIF equations, and other causes. If the import price for a certain region increases relative to the average market price, less consumption relative to other suppliers is expected in the final market. Total market demand variables measure total consumption of fresh oranges in the final market. It is a measure of the size of the market. Economic theory and the empirical results in Chapter 5 indicate that both variables help to determine trade flows. Relative price and total market demand variables were included in the sensitivity analysis.

Sensitivity Analysis

This section of the chapter will present and evaluate the results of the sensitivity analysis. Each type of equation will be addressed separately. The analysis and discussion will focus on major trading regions. To ease the presentation and discussion, a graphical analysis constructed using the sensitivity analysis indices was developed. The figures will be used to evaluate individual market behavior and to compare them among regions. The indices generated in the sensitivity analysis are included in Appendix J.

The figures show, on the bottom axis, an index that represents the right-hand side variable modified. The variable varies, depending on the

equation analyzed. By construction, this index always goes from .7 to 1.3 independently of the variable considered. That is, the right-hand side variable has been modified over that range. On the left axis, the index represents the endogenous or response variable. The specific variable on the left axis could be total market demand, export supply, or product demand depending on the equation studied. The index varies, depending on the type of response of the endogenous variable in each case. The response depends on the percentage change in the right-hand side variable and the magnitude and sign of the estimated parameter.

The right-hand side variable index and the endogenous or response variable index were used to construct the figures. Each figure shows the regions in order of importance. The first region presented corresponds to the most important region in the figure, the second to the next most important, etc. The most important region corresponds to the largest consuming region or importer for total market demands and to the largest exporting region for export supplies. The criterion for product demands was based on trade-flow volumes between partner regions and the final market.

The first section will center on total market demands, the second on export supplies, and the third on product demands. In each case, the discussion will address consumers, importers, exporters, and trading partners. A summary regarding this section of the chapter will be presented at the end.

Total Market Demands

As shown in Table 6.1, six regions consumed 90.7% of total world fresh orange consumption from 1966 to 1986. The regions were Latin America, Far East, Middle East/North Africa, Mediterranean-EC, EC, and the United States. A different group of six regions accounted for 99.5% of total world fresh orange imports. In this case, the regions were EC, Communist Bloc, rest of Western Europe, Canada, Far East, and Middle East/North Africa. Given that some regions were important as consumers and others as importers, the following analysis will cover both groups.

Two of the four variables included in the total market demand equations were considered in the sensitivity analysis, the average market price and income (GDP). These variables were selected based on the implications of economic theory and the empirical results from Chapter 5. Figures 6.1 to 6.4 present the sensitivity analyses for total market demand equations. Figures 6.1 and 6.2 show total market demands while changing the average market price for major world consumers and importers, respectively. Figures 6.3 and 6.4 present total market demand responses to changes in income (GDP) for major world consumers and importers, respectively.

Average market price

Figure 6.1 presents the total market demands while changing the average market price for major world consumers. The bottom axis shows the average market price index with the index extending from .7 to 1.3. The response or total market demand index is shown on the left axis. In

Table 6.1 World Demand, Imports and Exports Share Per Region
(Cummulative 21 Year Period 1966-1986)

Region	% of Total Demand	% of Total Imports	% of Total Exports
United States	7.12	1.20	8.90
Canada	0.75	4.81	0.00
Latin America	28.59	0.06	3.92
Mediterranean-EC	10.59	0.07	44.00
EC	9.92	63.43	0.25
Rest of Western Europe	1.64	10.57	0.05
Middle East/North Africa	11.51	1.65	34.95
Rest of Africa	2.46	0.16	6.24
Far East	23.02	4.29	1.09
Oceania	0.81	0.20	0.48
Communist Bloc	3.62	13.55	0.12
	100.00	100.00	100.00

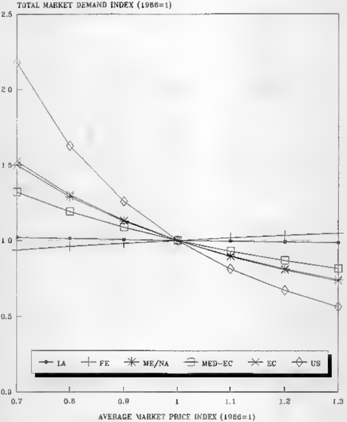

Figure 6.1. Total Market Demand Changing Average Market Price (Major World Consumers).

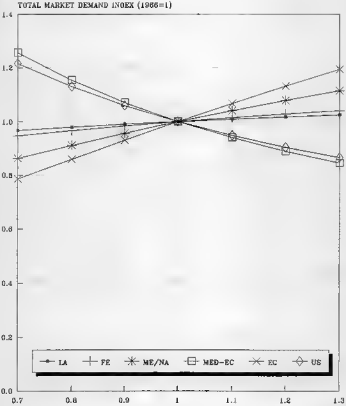

Figure 6.2. Total Market Demand Changing Average Market Price (Major World Importers).

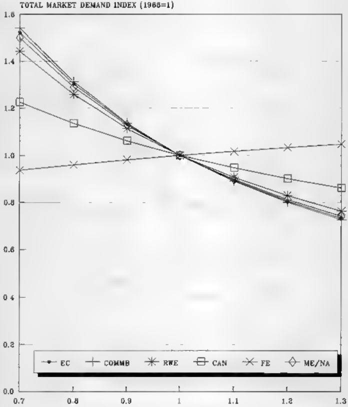

Figure 6.3. Total Market Demand Changing Income (GDP) (Major World Consumers).

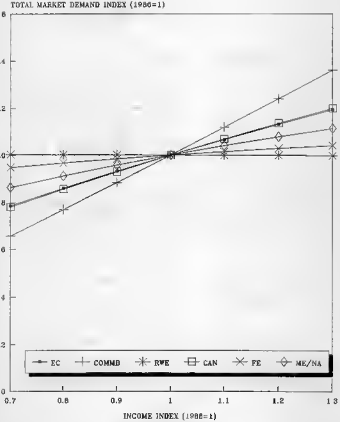

Figure 6.4 Total Market Demand Changing Income (GDP) (Major World Importers).

this case, the response index goes from below one up to approximately 2.2. In other words, it ranges from below the 1986 level up to approximately 2.2 times that level. The figure indicates that major world consumers have different responses to changes in the average market price. Since the response index depends on the magnitude and sign of the original parameter, a negative relationship is expected. As the average market price index increases, the total market demand index should decrease and vice versa.

The figure shows that responses are negative, with the exception of the Far East, and the magnitude of the responses differs from region to region. For example, a 10% increase in the average market price is represented on the bottom axis as 1.1. The values corresponding to the total market demand index, starting from the lowest, are .812 for United States; .893 for EC; .897 for Middle East/North Africa; .928 for Mediterranean-EC; .995 for Latin America; and 1.017 for the Far East (see Appendix J). The index numbers are less than one, except for the Far East. This result indicates that total market demands will be lower than the 1986 level in all regions after a 10% increase in the average market price. The only exception is the Far East. Recall from Chapter 5 that unique problems with the Far East equations were discussed.

The rest of the analysis will be based on the graphical results. The specific index numbers utilized to construct the figures are shown in Appendix J. The relative importance for each region is captured by the order in which the figures present the different regions. For example, Latin America is the largest consumer of fresh oranges in the world, therefore, Figure 6.1 lists Latin America in the first position.

Figure 6.1 indicates that, given changes in the average market price index, the total market demand index stays practically fixed. This implies that the average market price is not a major factor for local consumption in Latin America. The empirical results indicate that the average market price parameter, or elasticity, for Latin America is close to zero and not significant (see Table 5.1). The Far East is the second largest consumer in the world (based on reported data). The figure shows that, as the average market price index increases, the total market demand index also increases. The empirical results indicate that its average market price parameter is significant and inelastic. A possible explanation for the positive direction of the relationship was developed in Chapter 5. The argument included the characteristics of the market and consumers in terms of growth and quality requirements. Market growth is probably the most important factor to justify the wrong sign.

The figure shows that the total market demand indices for the EC and Middle East/North Africa are very similar. The empirical results indicate that both have elastic and significant parameters, implying that these regions react in a similar way to changes in their respective average market prices. The total market demand index for Mediterranean-EC is smaller than those for the EC and Middle East/North Africa. This indicates that Mediterranean-EC consumers are less sensitive to changes in their average market price. The empirical results indicate that it has an inelastic and significant parameter. The United States has the most elastic average market price parameter in the group. That is, fresh orange consumption in the United States is highly sensitive to changes in the average market price.

Figure 6.2 presents the same indices as Figure 6.1, but for major world importers. The bottom axis shows the average market price index. The left axis shows the total market demand index. In this case, the response index goes from below one up to approximately 1.5 times the 1986 level. This figure indicates that major world importers have different responses to changes in the average market price, but they are closer to each other than to the responses of major world consumers. The responses are negative as expected, with the exception of the Far East. The EC is the major world importer. It has an elastic price parameter or elasticity which is very similar to the ones from the Communist Bloc, Middle East/North Africa, and the rest of Western Europe. The empirical results indicate that the four elasticities are significant and lie between 1 and 1.22 (see Table 5.1). Canada's response is inelastic, implying that it is less sensitive to changes in the average market price than former regions.

Figures 6.1 and 6.2 indicate that regions with high import levels, such as the EC, Communist Bloc, rest of Western Europe, and Middle East/North Africa, have similar total market demand indices; and their parameters or elasticities are elastic. Regions with high consumption levels and low imports relative to consumption will tend to have lower average market price indices. Therefore, they are not very sensitive to changes in average market prices. This is the case for Latin America and Mediterranean-EC. These conclusions show that if world prices increase, major importers will tend to consume proportionally less than regions with low import levels. If world prices decrease, importers will tend to consume relatively more than regions with low import levels.

The figures also show that the United States has the largest response. Its parameter is the most elastic in the group, indicating that consumers in this market are highly sensitive to changes in the average market price. If world prices increase, consumers in the United States will consume proportionally less fresh oranges than other regions in the world. If world prices decrease, United States consumers will tend to consume more relative to the rest of the regions considered.

Income (GDP)

Figure 6.3 presents total market demand responses to changes in the income (GDP) level for major world consumers. The income index is shown on the bottom axis. The total market demand index is presented on the left axis. The expected relationship between income and demand is positive. As the income index increases, it is expected that the demand index also increases. The figure indicates that Latin America, Far East, EC, and Middle East/North Africa have positive relationships. The empirical results indicate that only the parameters for the EC and Middle East/North Africa are significant. The results also indicate that these parameters are inelastic (see Table 5.1).

The figure shows that the United States and Mediterranean-EC have negative responses. The empirical results indicate that the parameter for Mediterranean-EC is not significant. A negative total market demand index response produces lower consumption as income increases. This is the case for the United States, and it is an unexpected result. The negative relationship shows that fresh oranges are considered an inferior good in the United States. Consumers are expected to consume more of all normal

goods and shift to different good bundles as their income increases. A good is considered inferior when consumers reduce its consumption level as their income increases. In other words, the good is excluded from the new bundle selected. In Chapter 5, the "t" statistic for the parameter was compared with the rest of the statistics in the equation. The results were weak, when compared to the rest of the variables in the equation. This condition indicates that the income parameter may not be significant in this particular case.

Figure 6.4 presents total market demand responses to changes in income (GDP) level for major world importers. The income index is shown on the bottom axis. The total market demand index is presented on the left axis. The figure indicates that major world importers have similar income responses and most of them are positive as expected. The figure shows that only one negative relationship exists. This is the case for the rest of Western Europe; however, the empirical results indicate that it is not significant. The Far East has a positive response, but the empirical result was also not significant. The EC, Canada, and Middle East/North Africa relationships are positive and inelastic. Total market demand indices for the EC and Canada are practically the same. These responses show that as income increases (decreases), consumption will increase (decrease) in a lower proportion than the income change. The curve for the Communist Bloc indicates that the relationship is elastic. A 30% increase in income generates more than a 30% increase in consumption. Consumers in the Communist Bloc are more sensitive to changes in income levels than consumers in other regions.

Major importers have significant and more consistent results for changes in the income index than major consumers. Consumption of fresh oranges for major consumers with local production is less sensitive to changes in income. On the other hand, importers are more sensitive to changes in income levels, and their consumption and imports will increase or decrease as income increases or decreases.

If Figures 6.1 to 6.4 are compared, major importers (Figures 6.2 and 6.4) behaved in a similar way most of the time. The responses to the average market price index and income index were close among the regions and, in most cases, correct. Price and income parameters or elasticities for regions with high import percentages relative to their total consumption conform better to theoretical expectations and differ from those obtained in regions with large local production.

The results and the analysis developed could be used by any region to make policy decisions. The decisions could be related to domestic or trade policy. Knowledge about the different reactions that major consumers or major importers have to changes in the average market price and income is valuable market information. The results could be used to evaluate price policies, the competition level, the potential market, market development and growth, the impact of trade barriers, and other important factors.

Export Supplies

As shown in Table 6.1, three regions exported 87.8% of total world fresh orange exports in the period considered. The regions were the Mediterranean-EC, Middle East/North Africa, and the United States. The sensitivity analysis will focus on these three regions.

The variables analyzed were the FOB average export price and fresh orange production. Figures 6.5 and 6.6 present the sensitivity analyses for export supply equations. Figure 6.5 shows export supplies while changing the FOB average export price, and Figure 6.6 shows export supplies while changing fresh production.

FOB average export price

Figure 6.5 has the FOB average export price index on the bottom axis and the export supply index in the left axis. The expected economic relationship between export supply and the FOB average export price is positive. The figure shows that responses differ dramatically among regions. Mediterranean-EC curve indicates that its response to changes in the FOB average export price is close to zero. The response for the Middle East/North Africa is positive as expected, but the one for the United States is negative. The empirical results show that the "t" statistic for the United States is one, indicating that it is significant (see Table 5.2). The insignificance of the parameter obtained for Mediterranean-EC and the sign of the parameter for the United States show that the FOB average export price is not a major factor for export

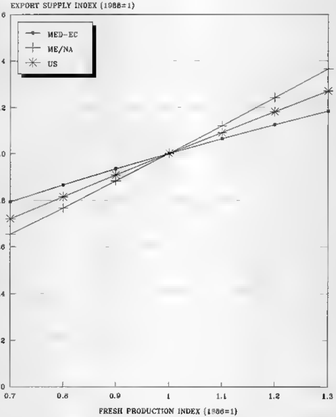

Figure 6.5. Export Supply Changing FOB Average Export Price (Major World Exporters).

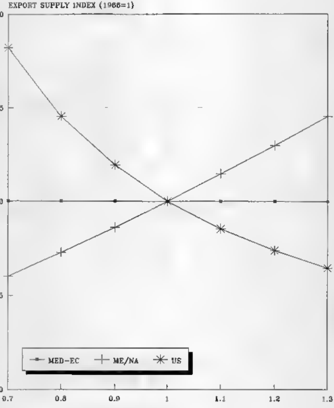

Figure 6.6. Export Supply Changing Fresh Production (Major World Exporters).

decisions in these regions. Middle East/North Africa has the correct positive response and it is also significant. The Mediterranean-EC and United States major exports are directed to captive markets, while the Middle East/North Africa has a larger clientele. These conditions partially explain why the Middle East/North Africa has the correct relationship.

Fresh production

Figure 6.6 presents export supplies changing fresh production. The fresh production index is on the bottom axis and the export supply index is on the left axis. The figure shows that, for the three regions, the relationship is positive and strong as expected. Fresh production is an important driving factor for exports. Mediterranean-EC and United States have inelastic relationships indicating that their exports change less than proportional to changes in fresh production (see Table 5.2). Middle East/North Africa has an elastic relationship; therefore, its exports are more sensitive to changes in fresh production. The differences in the export supply indices indicate that Mediterranean-EC and United States have larger local and/or captive markets than Middle East/North Africa. However, the relationships are close between each other and close to one in the three cases.

The sensitivity analyses indicate that export supply are driven mainly by fresh production. Production was considered exogenous, there may very well be a dynamic linkage between export growth and subsequent supply responses, the model does not consider these linkages. The export supply index while changing the FOB average price index is not conclusive,

with the exception of the Middle East/North Africa case. On the other hand, the behavior of the three major exporters is consistent and significant for the export supply index while changing fresh production. The Middle East/North Africa is the region that has the most flexible relationship regarding production and exports. This indicates that this region has better opportunities to take advantage of new or growing markets in the future.

Product Demands

A basic objective of the present study is to determine the major factors affecting consumers' decisions regarding fresh orange imports from alternative sources. Even though some of the 11 regions considered are not major importers, they all have potential significance in terms of the forecast and should be included in the sensitivity analysis.

Product demand equations include the relative price and total market demand variables. The relative price variable refers to the import price of a product coming from a given region relative to the average market price in the final market. If the import price from a certain region increases (decreases), it is expected that imports from that region will decrease (increase) relative to other regions in the final market. For simplicity in the following discussion, relative price will be called import price.

The total market demand variable refers to total market consumption. It represents the size of the final market. The change in the product demands relative to this variable could be positive or negative. Product

demand will depend on consumers' preferences with respect to product sources, as their total demand changes. For example, if the total market demand increases in a certain region, the consumers' next step will be to decide from which region to buy the extra product. The consumers' decision could be in favor or against any potential source. The analysis will consider market size increases and decreases. Market size decreases below the 1986 level are less likely to occur, given the behavior of fresh orange consumption in the last two decades.

The product demands were selected taking into consideration trade-flow volumes among the regions. For every region, a group of partners that accounted for over 90% of total imports were considered.

United States

Table 6.2 shows that Latin America, Middle East/North Africa, and Mediterranean-EC accounted for 98.1% of total United States imports in the period considered. Figures 6.7 and 6.8 present United States imports while changing import prices and total market demand. The sensitivity analysis presented in Figure 6.7 indicates that United States product demand behavior differs dramatically, depending on the product source. Latin America is the major exporter to the United States (based on reported data). The relationship between the import price index and product demand is positive in this event. This is an unexpected result, probably related to the fact that the United States is self-sufficient and imports exist only when local production is insufficient to fulfill consumers' demand. If this is the case, then a positive relationship is possible. As shown in the figure, the demand for Middle East/North Africa

Table 6.2 Region's Relative Imports Per Partner Region (% Cummulative 21 Year Period 1966-1986)

Region	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMM	TOTAL IMPORTS
US		0.04	83 82	2 70	0 04	0 00	11 71	0.04	1.07	0.10	0.00	100 00
CAN	78 57		1 23	1 00	0 01	0.00	5 40	3.44	8 50	0 00	0.00	100.00
LA	80 14	0.34		0 00	5 71	0.04	2 10	0.00	0 20	0 00	2 37	100 00
MED-EC	0 00	0 00	22.02		47.70	1 75	17 07	0 07	0 31	0 04	0.37	100 00
EC	1 82	0 00	3 28	54.10		0 03	32 00	7.00	0.01	0.11	0.10	100.00
RWE	0.04	0.00	1 02	43 41	1 50		47.55	5.33	0 04	0.16	0.05	100 00
ME/NA	1 40	0 00	14 03	0 37	1.12	1.05		28 40	30 47	4 23	0 05	100.00
RAF	0.10	0 70	5.00	7 01	13 00	0.05	60 10		8.15	3 83	0 05	100.00
FE	81.30	0.04	0 31	0 54	0.02	0 00	7 58	3.53		0.80	0.00	100.00
OCE	85.82	0 00	4.50	1 07	0.03	0 00	4 00	2 03	0.18		0.00	100.00
COMM	0.40	0.00	2 78	35 10	0.07	0.01	61 44	0 00	0 03	0.00		100.00

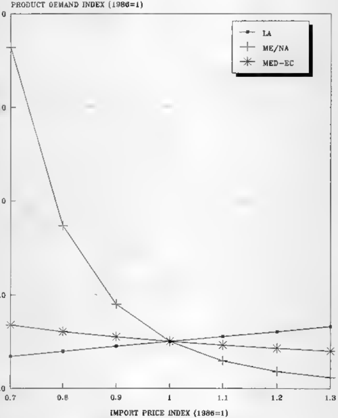

Figure 6.7. United States Imports Changing Import Prices.

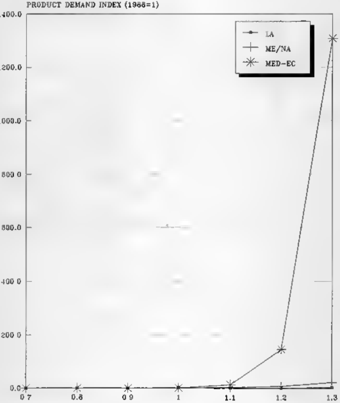

Figure 6.8. United States Imports Changing Total Market Demand.

product has the correct relationship and is highly elastic. A small change in the import price index produces a large change in the demand for this product in the United States. The relationship for the Mediterranean-EC is also negative, but the empirical results indicate that it is not significant (see Table 5.3). Consumption of the Mediterranean-EC product in the United States is not affected by changes in the import price. A similar change in the import price index for the Middle East/North Africa and Mediterranean-EC shows that the demand for the latter region's product is more stable. This opens an interesting opportunity for the Middle East/North Africa to increase its market participation in the United States. A small decrease in their import price in the United States would cause consumption of relatively more of their product than that from the Mediterranean-EC and other sources.

Figure 6.8 shows that United States product demands are sensitive to changes in the size of the market. Product demand indices for the three regions are positive and highly elastic to changes in total market demand indices. The figure and the empirical results show that Latin America has the smallest parameter or elasticity. Parameters for the Middle East/North Africa and Mediterranean-EC are over four and nine times the parameter for Latin America, respectively. Under these conditions, if the United States total market demand increases, consumers will prefer to buy the extra fruit first from the Mediterranean-EC, second from the Middle East/North Africa, and finally from Latin America. In all cases, these volumes of imports are still very small relative to total U.S. consumption of oranges.

Notice that the import price is not a relevant factor for demand of Mediterranean-EC product in the United States, however, it has the largest total market demand response. These characteristics imply that United States consumers rate Mediterranean-EC product in a premium position with respect to the rest of the fruit in the world market.

Canada

Table 6.2 indicates that 97.0% of Canada's imports came from four regions, the United States, Far East, Middle East/North Africa, and rest of Africa. Figures 6.9 and 6.10 show Canada's imports while changing import price and total market demand, respectively. Figure 6.9 presents the relationship between the import price index and the product demand index. The results of the sensitivity analysis indicate that only the demand for rest of Africa product has the incorrect relationship. The empirical results show that this parameter is not significant (see Table 5.4). The rest of the regions have negative and inelastic relationships, indicating that for similar percentage changes in the import price, consumers in Canada will react differently depending on the region of origin. The figure shows that, for a similar increase in the import price index, consumers will consume proportionally less from the Far East and United States than from the Middle East/North Africa. However, the empirical results indicate that the parameters for the United States and Middle East/North Africa are not significant.

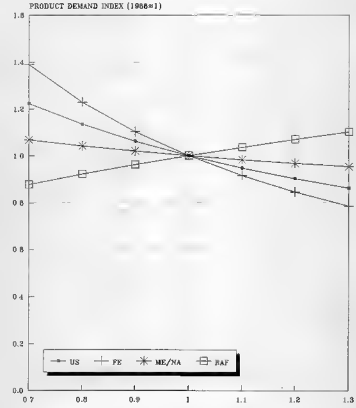

Figure 6.9. Canada Imports Changing Import Prices.

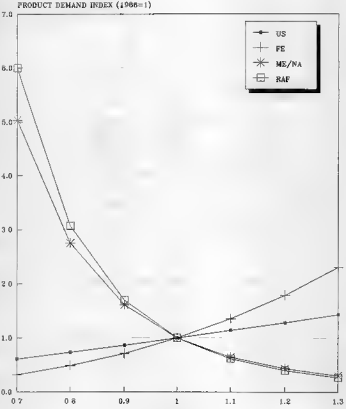

Figure 6.10. Canada Imports Changing Total Market Demand.

Figure 6.10 presents Canada's imports while changing total market demand. The figure indicates that, for the United States and Far East, the relationship between the total market demand index and the product demand index is positive. The rest of the regions have a negative association. The expected direction in this case is either negative or positive. Recall that, if the association between these indices is negative, consumers tend to consume less from a given region when the market size increases. The results imply that, as the Canadian market increases, consumers shift from Middle East/North Africa and rest of Africa to United States and Far East products. If the size of the market decreases, then the relative consumption of Middle East/North Africa and rest of Africa products with respect to the other regions will be larger. The demand for United States and Far East products is more stable, and both can take advantage of market size increases. The figure also shows that product demands are more sensitive to reductions below the base than to increases above the base market size. However, market size decreases are less likely to occur.

While the import price may not be a relevant factor for United States imports in Canada, it does have a positive and strong total market demand parameter. This characteristic suggests that Canadian consumers rate United States product in a premium position with respect to the rest of the fruit in the world market. Also, the closeness of the two countries and the ease of trade have likely impacted these results.

Latin America

Table 6.2 indicates that four regions accounted for 98.4% of total imports in Latin America. The regions are the United States, EC, Communist Bloc, and Middle East/North Africa. The sensitivity analysis presented in Figure 6.11 shows Latin America imports given changes in import prices. The EC and Middle East/North Africa have the correct negative association. The United States and Communist Bloc have positive relationships. Only the demands for the United States and Middle East/North Africa products are significant (see Table 5.5). The United States product demand has an unexpected result. It is probably related to the fact that Latin America is self-sufficient, and imports exist only when the market is experiencing a substantial shortage. If this is true, the direction of the relationship could be positive. On the other hand, it is expected that demand for Middle East/North Africa product will tend to decline relative to other products as import prices increase. The reverse could be expected if prices decrease.

Figure 6.12 presents Latin America imports while changing total market demand. The figure indicates that the United States and Middle East/North Africa have negative relationships, while the EC and Communist Bloc have positive associations. As total market demand increases, consumption for United States and Middle East/North Africa products will decline relative to other regions. This is especially true in this case, since the Communist Bloc and EC import price variables were not significant, indicating that import prices will probably not affect their demands. The Communist Bloc has the strongest relationship between

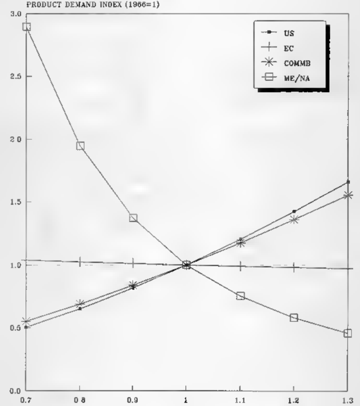

Figure 6.11. Latin America Imports Changing Import Prices.

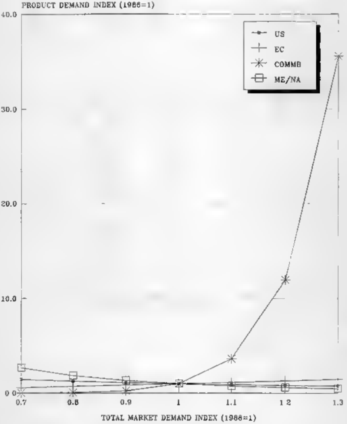

Figure 6.12. Latin America Imports Changing Total Market Demand.

product demand and market size. The empirical results indicate that the parameter for the Middle East/North Africa is not significant.

Mediterranean-EC

Table 6.2 indicates that four regions accounted for 89.2% of total imports in the Mediterranean-EC. The number of observations for this region was insufficient to estimate some of the equations. Lack of sufficient import information was expected, given that Mediterranean-EC was a net exporter of fresh oranges. The product demands estimated are for the EC, Latin America, Middle East/North Africa, and rest of Western Europe. The sensitivity analyses presented in Figure 6.13 indicate that three of the four regions have the correct negative relationship. The only positive association corresponds to Latin America, but the empirical result indicates that it is not significant (see Table 5.6). Middle East/North Africa and rest of Western Europe have similar responses. Their response is smaller than the one from the EC. If import prices increase, consumers will shift their relative consumption from the EC to other regions. The figure also indicates that demand for EC product is more sensitive to price decreases from the base year than it is to price increases from the base year. If import prices decrease, then the EC will capture most of Mediterranean-EC imports.

Figure 6.14 shows Mediterranean-EC imports changing total market demand. The figure indicates that all relationships are positive. The parameters for the Middle East/North Africa are not significant. With increases in the size of the Mediterranean-EC market, imports will come first from the rest of Western Europe, second from the EC and finally from

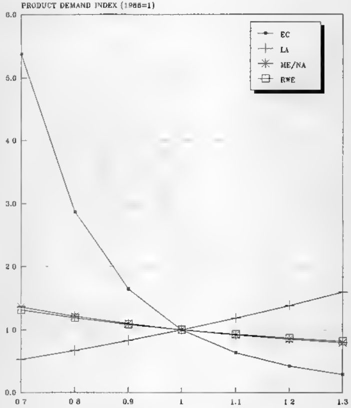

Figure 6.13. Mediterranean-EC Imports Changing Import Prices.

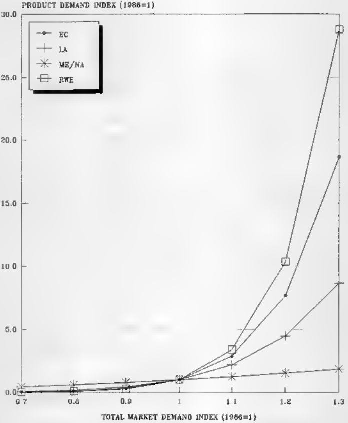

Figure 6 14. Mediterranean-EC Imports Changing Total Market Demand.

Latin America. Since rest of Western Europe is not a producer and EC production is small, then it is apparent that consumers' first choice will be Latin America and then the Middle East/North Africa. Given that Latin America product demand is not affected by import price changes, its position in the market is even stronger. As explained in Chapter 5, United Nations trade data tapes included exports from rest of Western Europe which are probably related to reexports.

EC

The EC is the world largest importer of fresh oranges. Table 6.2 indicates that five regions accounted for 99.6% of total imports during the period considered. The regions are the Mediterranean-EC, Middle East/North Africa, rest of Africa, Latin America, and the United States. As shown in Figure 6.15, two regions have the correct negative association between import price and product demand indices. The product demands for the other three regions have positive relationships, but two of them are not significant (see Table 5.7). Demand relationships for rest of Africa and United States products are negative and significant. However, the United States parameter is more elastic. As the import price index increases, consumers in the EC will shift their consumption from United States product to rest of Africa product. The demand for Middle East/North Africa product is positive and significant. This result might be related to the fact that the EC will buy product from the Middle East/North Africa only when market prices are increasing, due to

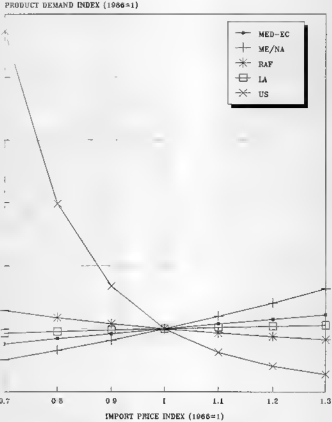

Figure 6.15. EC Imports Changing Import Prices.

insufficient fruit being provided by its major supplier, the Mediterranean-EC. Demands for Mediterranean-EC and Latin America products are not significant.

The sensitivity analysis presented in Figure 6.16 shows EC imports while changing total market demand. Mediterranean-EC, Middle East/North Africa, and Latin America show a positive association between total market size and product demands. The parameter for the Middle East/North Africa is not significant. Demand for this product is not affected by changes in the market size. United States and rest of Africa product demands show negative relationships. Only the one for the United States product is significant. As market size increases in the EC, consumers will shift their relative consumption from United States product to Mediterranean-EC and Latin America products. Mediterranean-EC and Latin America product have the best position for changes in the market size in this region.

Product demands while changing the import price for Mediterranean-EC and Latin America are not significant. Import prices may not play a relevant role for consumer decisions about imports from these regions. Still, both have positive and highly significant parameters for changes in the market size. If market size increases, consumers' first and second choices will definitely be Mediterranean-EC and Latin America products, respectively. This is an important result, mainly related to trade agreements between the EC and Mediterranean-EC.

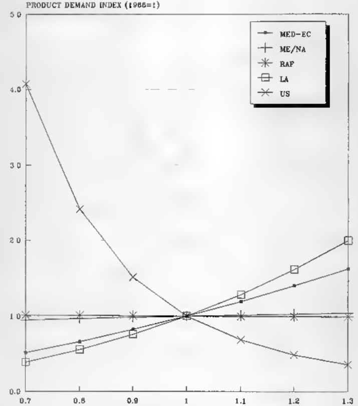

Figure 6.16. EC Imports Changing Total Market Demand.

Rest of Western Europe

Table 6.2 indicate that four regions accounted for 98.7% of total imports in the rest of Western Europe. The sensitivity analysis is presented in Figures 6.17 and 6.18. Figure 6.17 shows the relationships for the import price and product demand indices. The figure indicates that three of the four relationships have the correct negative direction. Only the demand for the rest of Africa product has a positive and significant association (see Table 5.8). The responses of the other three product demands with negative relationships are very similar, indicating that consumers in the rest of Western Europe will not shift their consumption among sources if all prices change proportionally.

Figure 6.18 indicates that the relationships between the total market demand indices and the product demand indices are positive in all cases. The parameter for the Middle East/North Africa is not significant, indicating that demand for this product is not affected by change in market size. The figure shows that responses are different among regions. It shows that, if market size increases, consumers will increase their consumption first from the EC product, second from the Mediterranean-EC, and third from the rest of Africa.

The results indicate that the rest of Africa import price/product demand relationship is not significant. The positive and relatively strong association between product demand and market size gives this region an opportunity to take advantage of potential market growth.

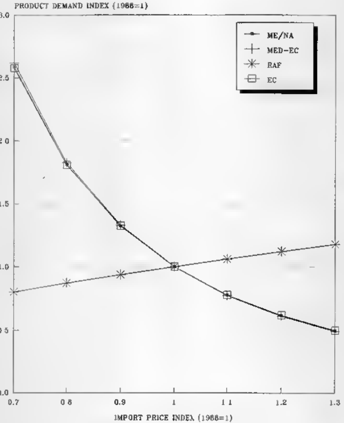

Figure 6.17. Rest of Western Europe Imports Changing Import Prices.

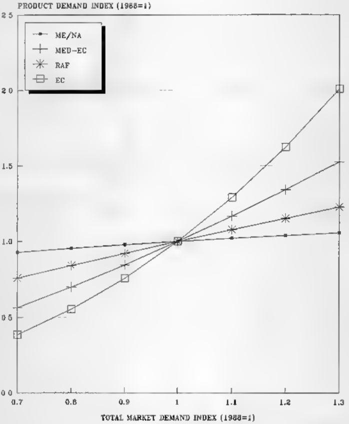

Figure 6.18. Rest of Western Europe Imports Changing Total Market Demand.

Middle East/North Africa

As indicated in Table 6.2, 96.9% of total Middle East/North Africa imports came from the Far East, rest of Africa, Latin America, Mediterranean-EC, and Oceania. The sensitivity analysis shown in Figure 6.19 presents the Middle East/North Africa product demand index while changing the import price index. The figure indicates that three of the five major product demands have negative relationships. Far East and Oceania parameters are negative and significant (see Table 5.9). Demand for the rest of Africa product has also a negative association, but it is not significant. Latin America and Mediterranean-EC have positive but insignificant relationships. The figure indicates that Far East and Oceania responses are different to changes in the import price index. Oceania has a stronger response than the Far East. Demand for Oceania product in the Middle East/North Africa is more sensitive to changes in import prices. If Oceania and Far East import prices increase in the same proportion, consumers in the Middle East will consume more product from the Far East relative to Oceania product. The reverse happens when import prices decrease.

Figure 6.20 presents Middle East/North Africa imports while changing total market demand. The sensitivity analysis indicates that all responses are positive and strong. The demand for Latin America product has the strongest response. The second strongest corresponds to the rest of Africa product. The third, fourth, and fifth places correspond to Oceania, Mediterranean-EC, and Far East, respectively. The results imply that, if market size increases, Latin America product becomes the consumers' first choice. The rest of the regions will also have a

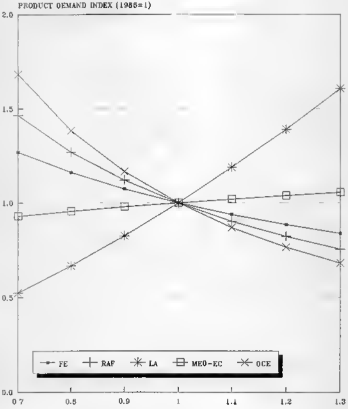

Figure 6.19. Middle East/North Africa Imports Changing Import Prices.

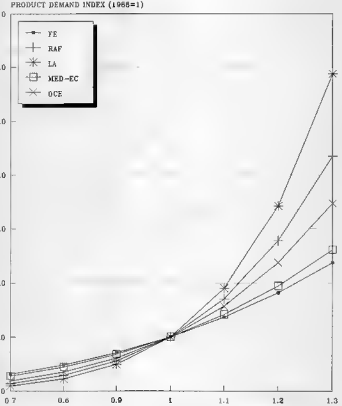

Figure 6.20. Middle East/North Africa Imports Changing Total Market Demand.

positive output for market size increases. Latin America and rest of Africa will probably have the major relative gains. It is worth mentioning that this market has been growing rapidly in the last two decades. This establishes an excellent opportunity for exports, especially from Latin America and rest of Africa.

Rest of Africa

Table 6.2 indicates that 99.6% of rest of Africa total imports came from five regions: the Middle East/North Africa, EC, Mediterranean-EC, Latin America, and Oceania. The sensitivity analysis shown in Figure 6.21 presents rest of Africa imports while changing import prices. The figure indicates that three out of the five regions have negative relationships. The correct negative associations correspond to the Mediterranean-EC, Latin America, and Oceania. The demand elasticity for Mediterranean-EC product is not significant. The results indicate that, if a similar increase in the import price of Latin America and Oceania products occur, consumers will tend to consume more product from Latin America relative to Oceania. Demand elasticities for Middle East/North Africa and EC products are positive, but only the former is significant. The wrong direction of the relationship for the Middle East/North Africa product could be related to the fact that the rest of Africa is self-sufficient and a net exporter of fresh oranges. It is possible to argue that imports from its major supplier occur only when domestic supply is insufficient and prices are rising.

Figure 6.22 shows rest of Africa imports while changing total market demand. As shown in the figure, only the demand for Oceania product has

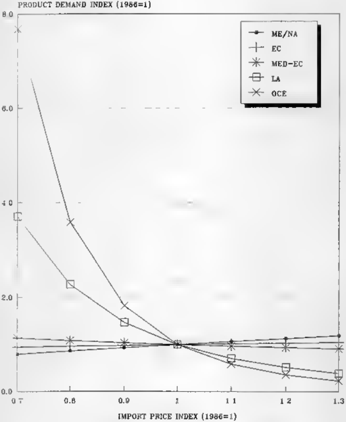

Figure 6.21. Rest of Africa Imports Changing Import Prices.

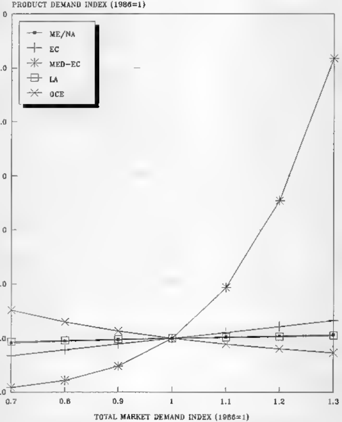

Figure 6.22. Rest of Africa Imports Changing Total Market Demand.

a negative response to changes in the market size. If the rest of Africa market size increases, consumers will move away from the Oceania product to consume more product from the other regions.

Even though the Mediterranean-EC and EC have insignificant import price/product demand relationships, they have the only significant parameters for the market size index. Import prices may not effect demand for these products in the rest of Africa; however, if the market size increases, consumers will purchase the extra product from these regions first. This is an important result that is probably related with some type of trade agreement among the regions.

Far East

As indicated in Table 6.2, 99.1% of Far East imports came from four regions, the United States, Middle East/North Africa, Oceania, and rest of Africa. The United States is the major exporter and represented 81.4% of total imports in the period considered. Figure 6.23 presents Far East imports while changing the import price index. As shown in the sensitivity analysis and the empirical results, the demand relationship for United States product is positive and significant (see Table 5.11). Given the characteristics of the Far East market and consumers in terms of fast growth and high-quality products, the positive direction could be justified. An interpretation of the positive association is not an easy task. However, considering the high percentage of United States fruit in the Far East markets, it is possible that import prices do not play a relevant role for United States-product import decisions in the Far East. The rest of the regions have negative relationships between import price

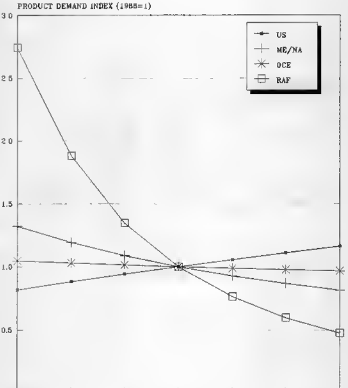

Figure 6.23. Far East Imports Changing Import Prices.

and product demand indices. Demand elasticity for the Oceania product is not significant. If Middle East/North Africa and rest of Africa import prices go up in similar proportions, consumers will consume relatively more of the Middle East/North Africa product.

Figure 6.24 presents Far East imports while changing total market demand. As expected, one of the strongest relationships corresponds to United States. This implies that consumers are willing to import more from the United States than from any other region in the world as market size increases. This fact, and the possibility that the United States import price may not be a major concern to consumers, give the United States an interesting position to penetrate the Far East market with fresh oranges. The rest of Africa also has a strong response to changes in market size. However, the empirical results indicate that it is not significant. Oceania has a positive and significant response, but it is not as strong as the one for the United States. The Middle East/North Africa response is negative but insignificant. The results show that, if the Far East market size increases, consumers will increase their consumption, mainly from the United States and Oceania. This is an important opportunity for these regions, given that the Far East is one of the regions with the fastest growth rates in the last two decades.

Oceania

Table 6.2 indicates that three regions accounted for 97.1% of Oceania's total imports in the period considered. The regions are the United States, Middle East/North Africa, and Latin America. The United States is the major exporter and represented 85.9% of total imports. The

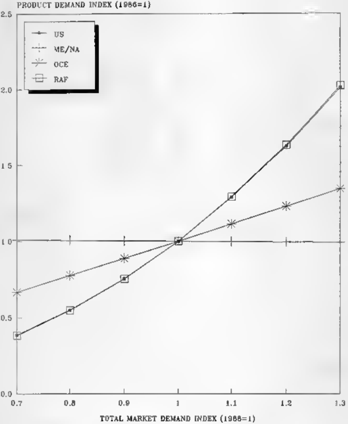

Figure 6.24. Far East Imports Changing Total Market Demand.

associations between import price and product demand indices presented in the sensitivity analysis are negative and significant for United States and Middle East/North Africa products (see Figure 6.25). Latin America has an incorrect positive and significant relationship (see Table 5.12). The direction of this association could be the result of a relatively small trade between the regions. The strongest negative relationship corresponds to the Middle East/North Africa. That is, if the United States and Middle East/North Africa import prices increase proportionally, consumers will consume relatively more product from the United States. If import prices decrease, consumers will tend to consume relatively more from the Middle East/North Africa.

Figure 6.26 and the empirical results indicate that the United States has an important advantage in Oceania. It is the only region with a positive and significant relationship between total market demand and product demand indices. The other regions have significant and highly negative relationships. If Oceania market size increases, consumers will import most product from the United States.

Communist Bloc

As indicated by Table 6.2, three regions accounted for 99.4% of the Communist Bloc imports in the period considered. The regions are the Middle East/North Africa, Mediterranean-EC, and Latin America. Figure 6.27 presents Communist Bloc imports while changing import prices The figure shows that two of the three regions have the correct negative relationship. The Mediterranean-EC has a positive but insignificant relationship (see Table 5.13). That is, import prices from this region

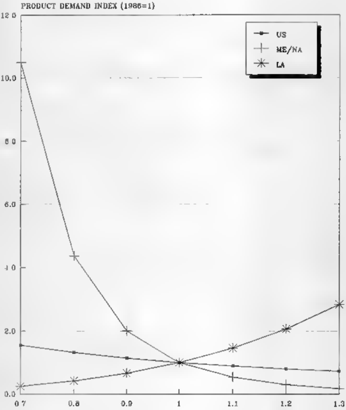

Figure 6.25. Oceania Imports Changing Import Prices.

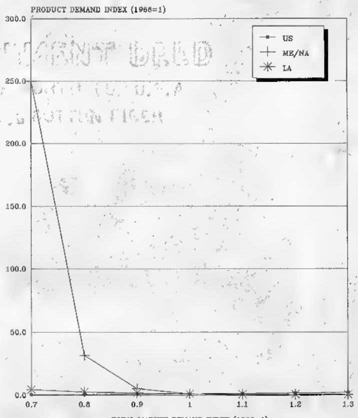

Figure 6.26. Oceania Imports Changing Total Market Demand.

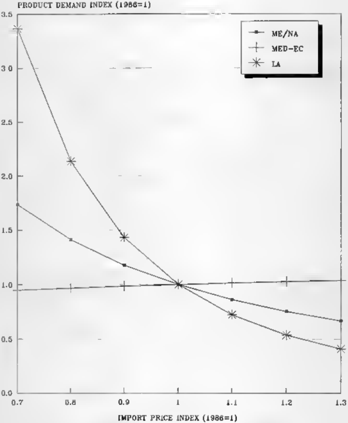

Figure 6.27. Communist Bloc Imports Changing Import Prices.

are not a major factor for import decisions in the Communist Bloc. The figure also indicates that demand for Latin America product has the strongest response. If import prices for Latin America and the Middle East/North Africa increase proportionally, consumers will consume relatively more product from the Middle East/North Africa than from Latin America. If import prices decrease, then the reverse is true.

Figure 6.28 shows Communist Bloc imports changing total market demand. The results indicate that the three product demands have a positive and significant response to changes in total market demand. The strongest response is for Latin America product, followed by Middle East/North Africa product. The response for the Mediterranean-EC is small but significant. The sensitivity analysis implies that, if the Communist Bloc market size increases, Latin America product will have the strongest position to penetrate the market. The Middle East/North Africa will have the second position and Mediterranean-EC the last one.

Mediterranean-EC has an insignificant import price/product demand relationship. This condition, combined with the analysis on the market size, gives this region an advantageous position to penetrate the Communist Bloc market.

Summary

This section of the chapter discussed the sensitivity analysis results. Regions were analyzed and compared with other regions. Each major equation of the model was discussed separately. The results in

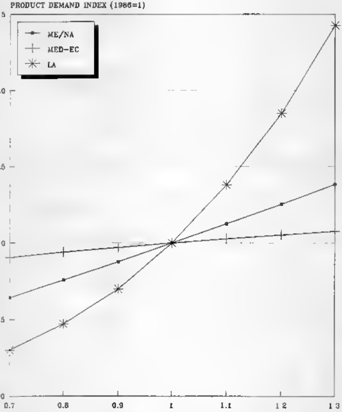

Figure 6.28. Communist Bloc Imports Changing Total Market Demand.

each section indicated that domestic and trade-policy decisions can be enhanced using the information generated in the sensitivity analysis.

Total market demand analysis concluded that if world prices increase, major importers will consume proportionally less than regions with low import levels and high local production. If world prices decrease, importers will consume relatively more than regions with low import levels. The analysis also shows that the largest response coincides with the United States, implying that consumers in this market are highly sensitive to changes in the average market price. If world prices increase, the percentage adjustment in demand by U.S. consumers will be greater than the percentage downward adjustment seen in the other regions. If world prices decrease, United States consumers will consume more relative to the rest of the regions considered. If a region is interesred in increasing exports to another region, the information provided in this section of the chapter could be used for price policy decisions and price discrimination.

Export supply equations show weak FOB average export price parameters versus very strong and significant fresh production parameters. This indicates that major export decisions are driven mainly by fresh production (see Sparks results for vegetables). Since fresh orange production implies a long-term decision, the results are appealing. Middle Eaer/North Africa exports have the correct relationship. This is probably related to the fact that its industry is completely open, while the Mediterranean-EC has important trade agreements with major partners, and the United States with Canada. The results indicate that the Middle East/North Africa is the region with the most flexible relationship

regarding production and exports. This region has better opportunities to take advantage of new or growing markets in the future. However, product quality has to be improved in order to take advantage of any new opportunity.

Product demand analysis provides important information for exporters and importers. The following conclusions will be made from the point of view of the exporting regions. The United States has good opportunities to increase and/or maintain its market share in four regions: Canada, Latin America, Far East, and Oceania. In most regions, the United States holds a premium position. The most promising region is the Far East, which is one of the faster growing regions in the world. Latin America apparently has better opportunities in the EC, Mediterranean-EC, Middle East/North Africa, and Communist Bloc. Its best market position is found in the Middle East/North Africa, which is one of the faster growing regions. Mediterranean-EC has better opportunities in the United States, EC, rest of Africa, and the Communist Bloc. Its holds a premium position in all regions, indicating that its fruit quality levels are high and consumers are willing to pay the price. The Middle East/North Africa has opportunities in the United States and the Communist Bloc. Its competitive position in most markets is not good. In most regions, its market size parameter is negative, probably indicating that quality standards are poor. The rest of Africa has opportunities in the rest of Western Europe and Middle East/North Africa. Its position is especially strong in the rest of Western Europe. The Far East holds a strong second position in the Canadian market. Oceania has an important opportunity in the Far East market. Its geographical position is better than its major

competitor, the United States, and the Far East market is growing fast. Finally, the Communist Bloc, in particular Cuba, has an opportunity to export mostly to Latin America.

The conclusions presented above represent the point of view of the exporting regions. Conclusions regarding importers will not be presented here since most of them are included in each region's analysis. In addition, if an exporting region A is said to have a good market position in region B, it means that for region B its best choice is A.

The results and the analysis developed could be used by any region to make policy decisions. The decisions could be related to domestic or trade policy. Knowledge about the different reactions that consumers, importers, and exporters have to changes in market price, income, the FOB average export price, fresh production, the relative import price, and market size is valuable market information. The results could be used to evaluate policy decisions about price, price discrimination, the competition level, the potential market, market development and growth, the impact of trade barriers, and other important factors.

Conclusion

The objective of the present chapter was to develop a framework to perform a comparative static analysis of the estimated parameters. A sensitivity analysis procedure was developed in such a way that the results could be evaluated and compared among regions.

The purpose of the analysis was to assess the impact in the dependent variables given changes in the right-hand side variables. Major

consumers, importers, and traders were included in the analysis. The results of the sensitivity analysis were used to develop a simple graphical framework to study the different markets' behavior and compare them among regions.

The results and the analyses turn out to provide relevant information for every participating region in the fresh orange trade model. The discussion also provided additional information to complement the more technical analysis developed in Chapter 5.

CHAPTER 7
SUMMARY AND CONCLUSIONS

Introduction

The present study developed a fresh orange trade model to study the major factors affecting exporter and consumer decisions in 11 regions of the world. The specific objectives were: to specify a multiple-region equilibrium world trade model for the fresh orange industry; to analyze the implications contained in the estimated model; to use the estimated parameters to study analytically the reasons for changes in market shares; and to develop a sensitivity analysis under different economic scenarios to make contributions to specific policy issues.

Even though the fresh orange market has experienced important growth, several countries, including the United States, have experienced pronounced changes in their trade patterns. The fresh orange industry is of enormous importance for some regions, especially for the United States, South America, Mediterranean-EEC, Middle East/North Africa, and Far East, as producers, consumers, and exporters. Producers and exporters need to understand the major driving factors for fresh consumption and their competitive position in foreign markets. Such information will allow them to compete with its benefits, possibly achieve international success, and help to develop new markets. This industry is also important for net importers such as Canada, EEC, rest of Western Europe, and the Communist

Bloc. These regions are interested in knowing which are the major driving factors for fresh consumption, and demand and price linkages between the region and its major trading partners.

Studying the fresh orange trade flows and modeling these changes provided information to help understand the reasons for changes in market shares among major suppliers and facilitate longer term forecasts and policy analyses. To accomplish the objectives of the present study, international trade linkages among the major trading regions were identified. It was also necessary to recognize the current and emerging problems in the industry. This information was helpful in studying the changes in trade patterns arising from changes in supply and demand conditions, and from changes in policy variables such as tariff levels and institutional constraints.

The dissertation includes six chapters. Chapter 1 presents a discussion related to the importance of world trade and, in particular, agricultural trade. It also presents a discussion about the orange industry including fresh and processed oranges. The chapter concludes that it is important to many countries and regions to study the trade flows and market shares of the fresh orange industry from a world perspective. Chapter 2 presents a discussion about world production and trade flows for the 11 regions selected. Trade volumes by region and partner region are discussed from 1966 to 1986. The chapter provides important insights about trade-flow and market-share changes in the different regions for the period considered. Chapter 3 presents a literature review regarding trade models. Agricultural trade models and, in particular, fresh and processed orange trade models are covered.

Chapter 4 develops the fresh orange trade model used in the present study. The theoretical background and the empirical model to be estimated are presented. Chapter 5 discusses the methods used for the estimation of the model. It also develops graphical, statistical, and economic analyses to study the performance of the model and the implications of the results. Chapter 6 presents a sensitivity analysis to study the changes in the total market demands, export supplies, and product demands, given changes in the right-hand side variables.

Data Limitations

The data required for this model has serious limitations. It is necessary to have all trade flows, import and export value, and quantity for every country of the world, showing the partner country. The data are then aggregated by region. If all countries of the world are included, the data are not available except from the United Nations trade data tapes. These data are gathered by each member country and sent to the statistics office in New York. The price data used in this dissertation are unit prices obtained by dividing value by quantity for each trade flow. As expected in trade data, many errors were found. Most of them were probably related with gathering problems and inconsistencies. Where errors were detected, the data were corrected in what was believed to be the most appropriate way.

Tariff barriers for fresh oranges were not available in a single document for all countries. It was necessary to review many different sources to obtain the final data presented in Appendix E. Tariffs of the

individual countries were averaged, using different methods to obtain the regional tariff. Nontariff barriers were not considered in the study, given that most of them are seasonal and the model uses annual data.

Fresh and processed orange utilization was not available for most countries. It was necessary to do a detailed literature review, including government reports, books, magazines, other publications and personal contacts to obtain the necessary information for each country included in the study. The information was then aggregated by region.

The regional CPIs based on Edwards and Ng (1985) theory were not available for the regions considered. It was necessary to create the data set for each country and region. Appendix H presents the detailed procedure utilized to get the final numbers. The first step was to obtain the domestic CPIs or inflation rates and the exchange rate index per country. The domestic CPIs were divided by the exchange rate index to get the CPIs per country. Finally, the CPIs per country were weighted using the 1986 trade volume to obtain the regional CPIs.

Estimation and Sensitivity Analysis Difficulties

A nonlinear two stage least squares procedure was utilized for the estimation of the model. While the model is simultaneous and large, it was still possible to estimate the model by sections in a Personal Computer, using TSP. Estimation capabilities have improved considerably in the last two years, thus greatly facilitating the use of the personal computer.

The size of the fresh orange trade model developed here, with 440 equations of which 242 were estimated, leaves little space to improve individual equations by correcting the functional form, the variables included, or any other alternative solution. Large trade econometric models like the one developed here are used to provide information about major trends and shifts of trade flows and market shares through the years among the different regions. The model provided important information about the behavior of the fresh orange industry. This information could be used for policy decisions in the different regions and countries.

If a particular trade flow is of interest and more information is needed, it is possible to review the particular functional form and obtain better results. However, if a single-equation estimation procedure is used, the results suffer from simultaneity bias.

An important limitation of the present study is that it was not possible to obtain the reduced-form parameters. If the reduced-form parameters were found, then the whole system of equations could have been simulated, given changes in the exogenous variables. Given the simultaneity embodied in the model, this is an important drawback. The limitation implies that the sensitivity analysis has to be developed on an equation by equation basis.

Performance of the Model and Results

The graphical and the statistical analyses provided sufficient information to determine that the model has a good fit, is well specified and predicted most turning points. The economic analysis shows that the

signs and magnitudes of the estimated parameter meet economic expectations in a majority of cases.

The model consists of 11 regions, including all countries of the world. It was found that trade is concentrated in a few regions. The performance of the model is better where significant trade took place. However, regions with small participation have important growing export or import markets; reducing the size of the model will hide important information and opportunities for some regions.

The analysis of the demand parameters showed the likely future direction of trade. Price elasticities were used to predict responses in the different markets to changes in prices. The role of prices as an allocative tool was shown. Income and population elasticities gave an indication of possible adjustments in consumption and trade patterns. Fresh production was found to be the most important factor contributing to world exports. Relative import price and market size were found to be important product demand drivers for most trade flows.

The model made forecasts of trade patterns among importers and exporters possible. The model was used to construct a sensitivity analysis to predict and compare total market demands, export supplies, and product demands responses among regions. Simulations were completed giving shocks in the different variables including average market price, income, relative prices, market size, FOB average export price and fresh production.

Contributions to Agricultural Economics Research

The dissertation represents the first multiple-region world trade model for the fresh-orange industry. The study provides a conceptual framework and model which can be used for international trade research on other individual agricultural products. The model is a modified spatial equilibrium model that follows Armington's demand theory that products are differentiated by place of origin. The model is a revised version of the Armington model, which is more flexible and capable of predicting most trade flows and market shares accurately. There has been only one other study that used a similar model (Sparks, 1987); however, in that case the model was used to study a highly aggregated commodity, fresh vegetables. This is the first time that the model has been applied to an individual good, which is more appealing, given that aggregated goods are difficult to differentiate.

Exchange rates are explicitly included and uniquely introduced in the present study for this type of model. The use of the United States CPI, instead of the regional CPIs, implies the assumption of purchasing power parity in all regions. The model utilized regional CPIs to obtain real prices and income.

The model was estimated using a simultaneous system of equations. There have been only two other studies which estimated this type of model in a simultaneous system (Deardorff and Stern, 1986; Sparks, 1987). Finally, the estimation procedure uniquely introduced different nonlinear relationships for the first step of the principal components procedure.

Further Research

There are many areas to which future research could be directed. The first would be to use the conceptual framework and model developed here in a different agricultural product. The changes to be made are minor and, obviously, related to the individual characteristics and trade patterns of the product selected.

Another interesting area of research would be to work with the fresh orange industry, modifying the model by reconsidering the number of regions and the country composition. It is also important to investigate and evaluate alternative functional forms for some of the equations. This would represent a tremendous amount of work, but it would probably provide a better model that could be used for many different products. It is important to recognize the significant changes in Eastern Europe which may affect some of the conclusions of the present study.

It was not possible to obtain the reduced form of the fresh orange trade model. It is important that future research pursue the possibility of obtaining the reduced-form parameters of the model. The procedure developed will be useful in many ways, since the same model can be used for other products.

The results of the present study suggest the presence of some specification problems. Specification tests other than the Durwin Watson where not conducted. An interesting area for future research will be to apply specification tests for this particular model and evaluate and measure the specification errors properly. Models such as used here with large number of equations do not lend themselves to certain types of test.

Furthermore, it is almost impossible to make some of the corrections that might be suggested by the specific test because of the interrelationship among the equations.

During the estimation process, the model was first estimated assuming purchasing power parity. The use of the work developed by Edwards and Ng (1985) improved the results of the model. Given that trade models usually utilize the United States CPI, trade research could benefit from this finding. More research is necessary to assure that world trade models will actually improve by using the CPIs per country, instead of using the United States' CPI.

One must constantly be aware of the inheritent data limitations and reporting problems using world trade data. Even so, this analysis shows that such data can be successfully used in modeling while recognizing the limitations.

APPENDIX A
COUNTRY COMPOSITION OF THE REGIONS

United States (US): United States.

Canada (CAN): Canada.

Latin America (LA): Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, Uruguay, Venezuela, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Antigua, Bahamas, Barbados, Dominica, Dominican Republic, Granada, Guadeloupe, Haiti, Jamaica, Netherlands-Antillas, Saint Lucia, Saint Vincent, Trinidad Tobago, Belize, Guyana, Panama, Panama Canal, Suriname.

Mediterranean-EC (MED-EC): Spain, Italy, Portugal and Greece.

EC: Belgium-Luxembourg, Denmark, France, West Germany, Ireland, Netherlands, United Kingdom.

Rest of Western Europe (RWE): Austria, Finland, Iceland, Norway, Sweden, Switzerland, Malta.

Middle East/North Africa (ME/NA): Algeria, Liby Arab JM, Morocco, Sudan, Tunisia, Egypt, Israel, Bahrain, Cyprus, Iran, Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Dem. Yemen, Syrian Arab RP, United Arab EM, Turkey, Yemen AR, Afghanistan.

Rest of Africa (RAF): South Africa, Cameroon, Central Africa REP., Chad, Congo, Gabon, Burundi, Cape Verde, Comoros, Zaire, Benin, Ethiopia, Djibouti, Gambia, Ghana, Cote Divoire, Kenya, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Niger, Nigeria, Reunion, Rwanda, Sao Tome

Frn., Senegal, Seychelles, Sierra Leone, Somalia, Zimbabwe, Togo, Uganda, United RP. Tanzania, Burkina Faso, Zambia.

Far East (FE): Japan, Bangladesh, Burma, Sri Lanka, Hong Kong, India, Indonesia, Korea Republic, Malaysia, Maldives, Nepal, Pakistan, Philippines, East Timor, Singapore, Thailand, Vietnam, China.

Oceania (OCE): Australia, New Zealand, Solomon Islands, Fiji, New Caledonia, Papua New Guinea, Samoa.

Communist Bloc (COMMB): Yugoslavia, Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, USSR, Cuba.

APPENDIX B
DERIVATION OF THE PRODUCT DEMAND EQUATIONS

If tha market demand aquations follow the CRES quantity index function of the product damanda, than:

(B.1) $X_{i.} = [b_{i1}*X_{i1}^{\alpha_{i1}} + b_{i2}*X_{i2}^{\alpha_{i2}} + \ldots + b_{im}*X_{im}^{\alpha_{im}}]^{(1/\alpha_{i})}$

Dafining tha tarm in paranthaais as Q, tha markat demand aquation can be writtan as follows:

(B.2) $X_{i.} = Q^{(1/\alpha_{i.})}$

Taking the partial derivative of the markat demand ($X_{i.}$) w.r.t. the product demands (X_{ij}) tha following raauit is obtainad:

(B.3) $\partial(X_{i.})/\partial(X_{ij}) = [1/\alpha_{i.}]*[Q^{(1/\alpha_{i.})-1}]*[\partial(Q)/\partial(X_{ij})]$

$= [1/\alpha_{i.}]*[X_{i} *X_{i.}^{-\alpha_{i}}]*[\alpha_{ij}*b_{ij}*X_{ij}^{(\alpha_{ij}-1)}]$

Equation (4) follows from tha firat ordar condition of utility maximization:

(B.4) $\partial(X_{i})/\partial(X_{ij}) * P_{i.} = P_{ij}$

which implias that

(B.5) $P_{i} = P_{ij}/[\partial(X_{i.})/\partial(X_{ij})]$

by substituting $\partial(X_{i.})/\partial(X_{ij})$ in (5), equation (6) holds:

(B.6) $P_{i} = P_{ij}/[(1/\alpha_{i.})*(X_{i.}^{-\alpha_{i.}}*X_{i.})*(\alpha_{ij}*b_{ij}*X_{ij}^{(\alpha_{ij}-1)})]$

Rearranging tarma and solving for tha product demands (X_{ij}), equations (7) and (8) follow:

(B.7) $X_{ij}^{\alpha_{ij}-1} = [\alpha_{i.}/(\alpha_{ij}*b_{ij})]\ [P_{ij}/P_{i.}] * [X_{i}^{(\alpha_{ij}-1)}]$

$$(B.8)\quad X_{ij} = [(\alpha_{i.}/(\alpha_{ij}*b_{ij}))^{(1/(\alpha_{ij}-1))}]*[(P_{ij}/P_{i.})^{(1/(\alpha_{ij}-1))}] *[X_{i.}^{(\alpha_{i.}-1)/(\alpha_{ij}-1)}]$$

Equation 4.24 in the text is the same as B.1. Equations 4.25 and 4.31 in the text follow directly from equation B.8.

APPENDIX C
PROCEDURE TO OBTAIN REGIONAL CPIs

The procedure developed by Edwards and Ng (1985) to obtain the regional CPIs (Consumer Price Indices) is the following:

1.- Get the percentage change of the CPIs per country (annual inflation)

2.- Get the exchange rates with respect to the U.S. dollar per country

3.- Get an index of the exchange rate for a base year

4.- Divide the CPIs by the exchange rate index to obtain the CPIs by country

5.- The individual country's CPIs are weighed using trade levels to obtain the regional CPIs aggregate values

APPENDIX D
PROCESSED ORANGE UTILIZATION

YEAR	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
					--- PERCENTAGE ---						
1966	68.1	0.0	4.5	12.3	0.0	0.0	6.7	10.1	5.5	18.7	0.0
1967	71.5	0.0	4.4	13.4	0.0	0.0	8.3	10.0	5.8	21.5	0.0
1968	71.3	0.0	8.2	14.8	0.0	0.0	10.0	12.0	8.0	24.7	0.0
1969	74.0	0.0	8.0	14.8	0.0	0.0	10.5	10.7	8.8	28.4	0.0
1970	74.4	0.0	10.0	14.8	0.0	0.0	10.0	10.5	7.5	12.7	0.0
1971	75.0	0.0	15.1	16.4	0.0	0.0	17.3	14.0	7.5	23.3	0.0
1972	75.5	0.0	23.1	11.8	0.0	0.0	33.8	10.2	10.4	27.8	0.0
1973	78.8	0.0	37.1	12.8	0.0	0.0	18.3	11.0	11.8	12.3	0.0
1974	77.4	0.0	28.2	12.3	0.0	0.0	13.4	14.0	8.3	18.7	0.0
1975	75.4	0.0	27.3	12.1	0.0	0.0	10.3	15.9	12.8	41.2	0.0
1976	77.5	0.0	31.2	12.2	0.0	0.0	8.4	11.0	11.8	45.5	1.7
1977	78.8	0.0	30.0	12.0	0.0	0.0	9.3	12.1	14.7	51.8	2.1
1978	78.1	0.0	17.9	12.7	0.0	0.0	7.8	11.4	12.4	50.8	2.5
1979	78.1	0.0	38.2	12.8	0.0	0.0	8.9	15.1	14.8	50.7	1.8
1980	78.8	0.0	40.8	11.4	0.0	0.0	8.8	13.1	14.4	57.4	1.1
1981	78.1	0.0	43.5	10.8	0.0	0.0	12.0	10.5	0.5	45.6	1.4
1982	72.4	0.0	48.3	13.1	0.0	0.0	9.1	8.4	10.4	52.9	1.5
1983	72.2	0.0	45.4	13.1	0.0	0.0	0.0	6.4	8.0	51.4	1.5
1984	70.1	0.0	48.4	10.4	0.0	0.0	12.1	10.2	4.4	54.0	5.2
1985	68.1	0.0	14.8	14.4	0.0	0.0	12.8	14.0	8.4	60.0	11.5
1986	67.7	0.0	49.3	15.4	0.0	0.0	13.0	10.1	8.8	58.2	12.4

Source: Prepared from different sources.

APPENDIX E
TARIFF DATA

Region	US	CAN	LA	MED-EC	SC	RWE	ME/NA	RAF	FE	OCE	COMMB
	--- % OF FOB EXPORT PRICE ---										
US[a]	0	21.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05	22.05
CAN	0	0	0	0	0	0	0	0	0	0	0
SA	25	25	25	25	15	25	25	15	25	25	25
MED-EEC[bc]											
66	12	11	12	10	2.0	12	0.7	12	12	12	12
67	12	11	12	10	2.0	12	0.7	12	12	12	11
68	12	11	12	10	2.0	12	0.7	12	12	12	12
69	12	11	11	10	2.0	12	0.7	12	12	12	12
70	11	11	12	10	2.0	12	0.7	12	12	12	11
71	12	11	12	10	2.0	12	0.7	12	12	12	12
72	11	11	12	10	2.0	12	0.7	12	12	12	12
73	12	11	12	0.2	2.0	12	0.30	12	12	12	11
74	11	11	11	0.2	2.0	12	0.30	12	12	12	12
75	11	11	11	0.2	2.0	12	0.30	12	12	12	12
76	12	11	12	0.1	2.0	12	0.30	12	12	12	11
77	11	11	12	0.2	2.0	12	0.30	12	12	12	11
78	12	11	12	0.2	2.0	12	0.30	12	12	12	12
79	12	12	12	0.2	2.0	12	0.10	12	12	12	11
80	12	11	12	0.2	2.0	12	0.10	12	12	12	12
81	11	11	12	0.2	2.0	12	0.10	12	12	12	12
82	12	12	12	0.1	2.0	12	0.10	22	12	12	11
83	12	11	12	0.1	2.0	12	0.10	22	12	12	11
84	11	12	12	0.2	2.0	12	0.10	12	12	12	11
85	12	12	12	0.2	2.0	12	0.10	12	12	12	11
86	12	11	11	0.2	2.0	12	0.10	22	22	12	12
EEC[bc]											
66	15	15	15	11.43	0	15	0.5	15	15	15	15
67	15	15	15	11.43	0	15	0.5	15	15	15	15
68	15	15	15	11.45	0	15	0.5	15	15	15	15
69	15	15	15	11.43	0	15	0.5	15	15	15	15
70	15	15	15	11.45	0	15	0.5	15	15	15	15
71	15	15	15	11.43	0	15	0.5	15	15	15	15
72	15	15	15	11.43	0	15	0.5	15	15	15	15
73	15	15	15	0.50	0	15	5.00	15	15	15	15
74	15	15	15	0.50	0	15	5.00	15	15	15	15
75	15	15	15	0.50	0	15	5.00	15	15	15	15
76	15	15	15	0.50	0	15	5.00	15	15	15	15
77	15	15	15	0.50	0	15	5.00	15	15	15	15
78	15	15	15	0.50	0	15	5.00	15	15	15	15
79	15	15	15	0.70	0	15	5.05	15	15	15	15
80	15	15	15	0.70	0	15	5.05	15	15	15	15
81	15	15	15	0.70	0	15	5.05	15	15	15	15
82	15	15	15	0.70	0	15	5.05	15	15	15	15
83	15	15	15	0.70	0	15	5.05	15	15	15	15
84	15	15	15	0.70	0	15	5.05	15	15	15	15
85	15	15	15	0.70	0	15	5.05	15	15	15	15
86	15	15	15	0.70	0	15	5.05	15	15	15	15
RWE	0	0	0	0	0	0	0	0	0	0	0
ME/NA	5	5	5	5	5	5	5	5	5	5	5
RAF	5	5	5	5	5	5	5	5	5	5	5
FE	40	40	20	40	40	40	40	20	40	20	40
OCE	0	0	0	0	0	0	0	0	0	0	0
COMMB	10	10	2.5	10	10	10	2.5	10	10	10	0

[a] U.S. dollars per metric ton
[b] % of CIF import price and tariffs vary by year.
[c] Tariffs differ by year.

APPENDIX F

PRINCIPAL COMPONENT PROCEDURE AND PROGRAM

```
FREQ A;
SMPL 66,86;
READ (FORMAT=LOTUS,FILE='C:\LOTUS\DATA.WK1');
? START OF PROGRAM;

LIST EXOG
POP1 GDP1     PRD1 CPI1 YEAR PEN BAVAL1
POP2 GDP2     PRD2 CPI2          BAVAL2
POP3 GDP3     PRD3 CPI3          BAVAL3
POP4 GDP4     PRD4 CPI4          BAVAL4
POP5 GDP5     PRD5 CPI5          BAVAL5
POP6 GDP6     PRD6 CPI6          BAVAL6
POP7 GDP7     PRD7 CPI7          BAVAL7
POP8 GDP8     PRD8 CPI8          BAVAL8
POP9 GDP9     PRD9 CPI9          BAVAL9
POP10 GDP10   PRD10 CPI10        BAVAL10
POP11 GDP11   PRD11 CPI11        BAVAL11;
PRIN (NAME=PC,NCOM=6,FRAC=.98,NOPRINT) EXOG;
PRINT PC1 PC2 PC3 PC4 PC5 PC6;
END;
```

The exogenous variables included in the principal component procedure are Population (POP), Gross Domestic Product (GDP), Production (PRD), Consumer Price Index (CPI), and Bananas and Apples Price Index per region (BAVAL). The Year Trend (YEAR) and the Price Index for Energy (PEN) were also included. PC1 to PC6 refer to the principal components obtained with the procedure.

APPENDIX C
ESTIMATION PROGRAM

The Program #1 below was used to estimate the market demand and export supply equations. The Program #2 was used to estimate the product demand equations for the United States. Since all regional programs are similar to the one presented for the United States, they will not be included here. The only differences among the regional programs are the variables used and parameters names.

<u>Program #1</u>

```
FREQ A;
SMPL 66,86;
READ (FORMAT=LOTUS,FILE='C:\LOTUS\DATA.WK1');
? START OF PROGRAM;

LIST EXOG;
POP1 GDP1     PRD1 CPI1 YEAR PEN BAVAL1 ;
POP2 GDP2     PRD2 CPI2          BAVAL2 ;
POP3 GDP3     PRD3 CPI3          BAVAL3 ;
POP4 GDP4     PRD4 CPI4          BAVAL4 ;
POP5 GDP5     PRD5 CPI5          BAVAL5 ;
POP6 GDP6     PRD6 CPI6          BAVAL6 ;
POP7 GDP7     PRD7 CPI7          BAVAL7 ;
POP8 GDP8     PRD8 CPI8          BAVAL8 ;
POP9 GDP9     PRD9 CPI9          BAVAL9 ;
POP10 GDP10  PRD10 CPI10         BAVAL10;
POP11 GDP11  PRD11 CPI11         BAVAL11;
PRIN (NAME=PC,NCOM=6,FRAC=.98,NOPRINT) EXOG;

? Alternative #1          ? Alternative #2          ? Alternative #3
PC1=.96**PC1;             PC1=PC1;                  PC1=.96**PC1;
PC2=.96**PC2;             PC2=PC2;                  PC2=.96**PC2;
PC3=.96**PC3;             PC3=PC3;                  PC3=.96**PC3;
PC4=.96**PC4;             PC4=PC1*PC1;              PC4=.96**PC4;
                          PC5=PC2*PC2;              PC5=.96**PC5;
                          PC6=PC3*PC3;              PC6=.96**PC6;
```

```
LEXQD1 = LOG(EXPORT1); LIQ1D = LOG(IQ1D);
LEXQD2 = LOG(EXPORT2); LIQ2D = LOG(IQ2D);
LEXQD3 = LOG(EXPORT3); LIQ3D = LOG(IQ3D);
LEXQD4 = LOG(EXPORT4); LIQ4D = LOG(IQ4D);
LEXQD5 = LOG(EXPORT5); LIQ5D = LOG(IQ5D);
LEXQD6 = LOG(EXPORT6); LIQ6D = LOG(IQ6D);
LEXQD7 = LOG(EXPORT7); LIQ7D = LOG(IQ7D);
LEXQD8 = LOG(EXPORT8); LIQ8D = LOG(IQ8D);
LEXQD9 = LOG(EXPORT9); LIQ9D = LOG(IQ9D);
LEXQD10 = LOG(EXPORT10); LIQ10D = LOG(IQ10D);
LEXQD11 = LOG(EXPORT11); LIQ11D = LOG(IQ11D);

PARAM
RH01 1 RH11 -1 RH21 1 RH31 1 DH01 1 DH11 1 DH21 1
RH02 1 RH12 -1 RH22 1 RH32 1 DH02 1 DH12 1 DH22 1
RH03 1 RH13 -1 RH23 1 RH33 1 DH03 1 DH13 1 DH23 1
RH04 1 RH14 -1 RH24 1 RH34 1 DH04 1 DH14 1 DH24 1
RH05 1 RH15 -1 RH25 1 RH35 1 DH05 1 DH15 1 DH25 1
RH06 1 RH16 -1 RH26 1 RH36 1 DH06 1 DH16 1 DH26 1
RH07 1 RH17 -1 RH27 1 RH37 1 DH07 1 DH17 1 DH27 1
RH08 1 RH18 -1 RH28 1 RH38 1 DH08 1 DH18 1 DH28 1
RH09 1 RH19 -1 RH29 1 RH39 1 DH09 1 DH19 1 DH29 1
RH010 1 RH110 -1 RH210 1 RH310 1 DH010 1 DH110 1 DH210 1
RH011 1 RH111 -1 RH211 1 RH311 1 DH011 1 DH111 1 DH211 1;

PARAM
RH41 1 RH51 1 RH47 1 RH57 1
RH42 1 RH52 1 RH48 1 RH58 1
RH43 1 RH53 1 RH49 1 RH59 1
RH44 1 RH54 1 RH410 1 RH510 1
RH45 1 RH55 1 RH411 1 RH511 1
RH46 1 RH56 1;

REPD1 = EPD1/CPI1;LREPD1 = LOG(REPD1);
REPD2 = EPD2/CPI2;LREPD2 = LOG(REPD2);
REPD3 = EPD3/CPI3;LREPD3 = LOG(REPD3);
REPD4 = EPD4/CPI4;LREPD4 = LOG(REPD4);
REPD5 = EPD5/CPI5;LREPD5 = LOG(REPD5);
REPD6 = EPD6/CPI6;LREPD6 = LOG(REPD6);
REPD7 = EPD7/CPI7;LREPD7 = LOG(REPD7);
REPD8 = EPD8/CPI8;LREPD8 = LOG(REPD8);
REPD9 = EPD9/CPI9;LREPD9 = LOG(REPD9);
REPD10 = EPD10/CPI10;LREPD10 = LOG(REPD10);
REPD11 = EPD11/CPI11;LREPD11 = LOG(REPD11);

OLSQ LREPD1, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD1H=@FIT;
OLSQ LREPD2, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD2H=@FIT;
OLSQ LREPD3, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD3H=@FIT;
OLSQ LREPD4, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD4H=@FIT;
OLSQ LREPD5, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD5H=@FIT;
OLSQ LREPD6, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD6H=@FIT;
OLSQ LREPD7, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD7H=@FIT;
```

```
OLSQ LREPD8, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD8H=@FIT;
OLSQ LREPD9, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD9H=@FIT;
OLSQ LREPD10, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD10H=@FIT;
OLSQ LREPD11, C, PC1, PC2, PC3, PC4, PC5, PC6; LREPD11H=@FIT;

RMP1D = MP1D/CPI1;LRMP1D = LOG(RMP1D);
RMP2D = MP2D/CPI2;LRMP2D = LOG(RMP2D);
RMP3D = MP3D/CPI3;LRMP3D = LOG(RMP3D);
RMP4D = MP4D/CPI4;LRMP4D = LOG(RMP4D);
RMP5D = MP5D/CPI5;LRMP5D = LOG(RMP5D);
RMP6D = MP6D/CPI6;LRMP6D = LOG(RMP6D);
RMP7D = MP7D/CPI7;LRMP7D = LOG(RMP7D);
RMP8D = MP8D/CPI8;LRMP8D = LOG(RMP8D);
RMP9D = MP9D/CPI9;LRMP9D = LOG(RMP9D);
RMP10D = MP10D/CPI10;LRMP10D = LOG(RMP10D);
RMP11D = MP11D/CPI11;LRMP11D = LOG(RMP11D);

OLSQ LRMP1D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP1DH=@FIT;
OLSQ LRMP2D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP2DH=@FIT;
OLSQ LRMP3D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP3DH=@FIT;
OLSQ LRMP4D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP4DH=@FIT;
OLSQ LRMP5D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP5DH=@FIT;
OLSQ LRMP6D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP6DH=@FIT;
OLSQ LRMP7D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP7DH=@FIT;
OLSQ LRMP8D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP8DH=@FIT;
OLSQ LRMP9D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP9DH=@FIT;
OLSQ LRMP10D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP10DH=@FIT;
OLSQ LRMP11D, C, PC1, PC2, PC3, PC4, PC5, PC6; LRMP11DH=@FIT;

FRML EQ1#19 LEXQD1 = (DH01 + DH11*(LREPD1H) + DH21*LOG(PRD1));
FRML EQ2#19 LEXQD2 = (DH02 + DH12*(LREPD2H) + DH22*LOG(PRD2));
FRML EQ3#19 LEXQD3 = (DH03 + DH13*(LREPD3H) + DH23*LOG(PRD3));
FRML EQ4#19 LEXQD4 = (DH04 + DH14*(LREPD4H) + DH24*LOG(PRD4));
FRML EQ5#19 LEXQD5 = (DH05 + DH15*(LREPD5H) + DH25*LOG(PRD5));
FRML EQ6#19 LEXQD6 = (DH06 + DH16*(LREPD6H) + DH26*LOG(PRD6));
FRML EQ7#19 LEXQD7 = (DH07 + DH17*(LREPD7H) + DH27*LOG(PRD7));
FRML EQ8#19 LEXQD8 = (DH08 + DH18*(LREPD8H) + DH28*LOG(PRD8));
FRML EQ9#19 LEXQD9 = (DH09 + DH19*(LREPD9H) + DH29*LOG(PRD9));
FRML EQ10#19 LEXQD10 = (DH010 + DH110*(LREPD10H) + DH210*LOG(PRD10));
FRML EQ11#19 LEXQD11 = (DH011 + DH111*(LREPD11H) + DH211*LOG(PRD11));

FRML EQ1#20 LIQ1D = (RH01 + RH11*(LRMP1DH) + RH21*LOG(GDP1/CPI1)
+ RH31*LOG(POP1) + RH41*LOG(BAVAL1/CPI1));
FRML EQ2#20 LIQ2D = (RH02 + RH12*(LRMP2DH) + RH22*LOG(GDP2/CPI2)
+ RH32*LOG(POP2) + RH42*LOG(BAVAL2/CPI2));
FRML EQ3#20 LIQ3D = (RH03 + RH13*(LRMP3DH) + RH23*LOG(GDP3/CPI3)
+ RH33*LOG(POP3) + RH43*LOG(BAVAL3/CPI3));
FRML EQ4#20 LIQ4D = (RH04 + RH14*(LRMP4DH) + RH24*LOG(GDP4/CPI4)
+ RH34*LOG(POP4) + RH44*LOG(BAVAL4/CPI4));
FRML EQ5#20 LIQ5D = (RH05 + RH15*(LRMP5DH) + RH25*LOG(GDP5/CPI5)
+ RH35*LOG(POP5) + RH45*LOG(BAVAL5/CPI5));
```

```
FRML EQ6#20 LIQ6D = (RH06 + RH16*(LRMP6DH) + RH26*LOG(GDP6/CPI6)
+ RH36*LOG(POP6) + RH46*LOG(BAVAL6/CPI6));
FRML EQ7#20 LIQ7D = (RH07 + RH17*(LRMP7DH) + RH27*LOG(GDP7/CPI7)
+ RH37*LOG(POP7) + RH47*LOG(BAVAL7/CPI7));
FRML EQ8#20 LIQ8D = (RH08 + RH18*(LRMP8DH) + RH28*LOG(GDP8/CPI8)
+ RH38*LOG(POP8) + RH48*LOG(BAVAL8/CPI8));
FRML EQ9#20 LIQ9D = (RH09 + RH19*(LRMP9DH) + RH29*LOG(GDP9/CPI9)
+ RH39*LOG(POP9) + RH49*LOG(BAVAL9/CPI9));
FRML EQ10#20 LIQ10D = (RH010 + RH110*(LRMP10DH) + RH210*LOG(GDP10/CPI10)
+ RH310*LOG(POP10) + RH410*LOG(BAVAL10/CPI10));
FRML EQ11#20 LIQ11D = (RH011 + RH111*(LRMP11DH) + RH211*LOG(GDP11/CPI11)
+ RH311*LOG(POP11) + RH411*LOG(BAVAL11/CPI11));

LSQ (NOPRINT,SILENT) EQ1#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ2#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ3#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ4#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ5#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ6#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ7#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ8#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ9#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ10#19;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ11#19;PRINT @RSQ, @DW, @FST;

LSQ (NOPRINT,SILENT) EQ1#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ2#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ3#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ4#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ5#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ6#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ7#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ8#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ9#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ10#20;PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ11#20;PRINT @RSQ, @DW, @FST;
END;
```

Program #2

```
? REGION 1;
FREQ A;
SMPL 66,86;
READ (FORMAT=LOTUS,FILE='C:\LOTUS\DATA.WK1');
? START OF PROGRAM;

LIST EXOG;
POP1 GDP1 PRD1 CPI1 YEAR PEN BAVAL1;
POP2 GDP2 PRD2 CPI2          BAVAL2;
POP3 GDP3 PRD3 CPI3          BAVAL3;
POP4 GDP4 PRD4 CPI4          BAVAL4;
```

```
POP5 GDP5 PRD5 CPI5             BAVAL5;
POP6 GDP6 PRD6 CPI6             BAVAL6;
POP7 GDP7 PRD7 CPI7             BAVAL7;
POP8 GDP8 PRD8 CPI8             BAVAL8;
POP9 GDP9 PRD9 CPI9             BAVAL9;
POP10 GDP10 PRD10 CPI10         BAVAL10;
POP11 GDP11 PRD11 CPI11         BAVAL11;
PRIN (NAME=PC,NCOM=6,FRAC=.98,NOPRINT) EXOG;

? Alternative #1          ? Alternative #2          ? Alternative #3
PC1=.96**PC1;             PC1=PC1;                  PC1=.96**PC1;
PC2=.96**PC2;             PC2=PC2;                  PC2=.96**PC2;
PC3=.96**PC3;             PC3=PC3;                  PC3=.96**PC3,
PC4=.96**PC4;             PC4=PC1*PC1;              PC4=.96**PC4;
                          PC5=PC2*PC2;              PC5=.96**PC5;
                          PC6=PC3*PC3;              PC6=.96**PC6;

LIQ1D = LOG(IQ1D);
                    LIP1_2 = LOG(IP1_2);
LIQ1_2 = LOG(IQ1_2);
LIQ1_3 = LOG(IQ1_3); LIP1_3 = LOG(IP1_3);
LIQ1_4 = LOG(IQ1_4); LIP1_4 = LOG(IP1_4);
LIQ1_5 = LOG(IQ1_5); LIP1_5 = LOG(IP1_5);
LIQ1_6 = LOG(IQ1_6); LIP1_6 = LOG(IP1_6);
LIQ1_7 = LOG(IQ1_7); LIP1_7 = LOG(IP1_7);
LIQ1_8 = LOG(IQ1_8); LIP1_8 = LOG(IP1_8);
LIQ1_9 = LOG(IQ1_9); LIP1_9 = LOG(IP1_9);
LIQ1_10 = LOG(IQ1_10); LIP1_10 = LOG(IP1_10);
LIQ1_11 = LOG(IQ1_11); LIP1_11 = LOG(IP1_11);

PARAM
TH012 1 TH112 -1 TH212 1 LH012 1 LH112 1 LH212 1 LH312 1
TH013 1 TH113 -1 TH213 1 LH013 1 LH113 1 LH213 1 LH313 1
TH014 1 TH114 -1 TH214 1 LH014 1 LH114 1 LH214 1 LH314 1
TH015 1 TH115 -1 TH215 1 LH015 1 LH115 1 LH215 1 LH315 1
TH016 .1 TH116 .1 TH216 .1 LH016 1 LH116 1 LH216 1 LH316 1
TH017 1 TH117 -1 TH217 1 LH017 1 LH117 1 LH217 1 LH317 1
TH018 1 TH118 -1 TH218 1 LH018 1 LH118 1 LH218 1 LH318 1
TH019 1 TH119 -1 TH219 1 LH019 1 LH119 1 LH219 1 LH319 1
TH0110 1 TH1110 -1 TH2110 1 LH0110 1 LH1110 1 LH2110 1
LH3110 1
TH0111 .1 TH1111 .1 TH2111 .1 LH0111 1 LH1111 1 LH2111 1
LH3111 1;

LEP2_1 = LOG(EP2_1);LEP3_1 = LOG(EP3_1);
LEP4_1 = LOG(EP4_1);LEP5_1 = LOG(EP5_1);
LEP6_1 = LOG(EP6_1);LEP7_1 = LOG(EP7_1);
LEP8_1 = LOG(EP8_1);LEP9_1 = LOG(EP9_1);
LEP10_1 = LOG(EP10_1);LEP11_1 = LOG(EP11_1);

DLSQ LEP2_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP2_1H=@FIT;
DLSQ LEP3_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP3_1H=@FIT;
```

```
OLSQ LEP4_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP4_1H=@FIT;
OLSQ LEP5_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP5_1H=@FIT;
OLSQ LEP6_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP6_1H=@FIT;
OLSQ LEP7_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP7_1H=@FIT;
OLSQ LEP8_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP8_1H=@FIT;
OLSQ LEP9_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP9_1H=@FIT;
OLSQ LEP10_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP10_1H=@FIT;
OLSQ LEP11_1, C, PC1, PC2, PC3, PC4, PC5, PC6; LEP11_1H=@FIT;

PM1_2=MP1_2/MP1D;
PM1_3=MP1_3/MP1D;PM1_4=MP1_4/MP1D;
PM1_5=MP1_5/MP1D;PM1_6=MP1_6/MP1D;
PM1_7=MP1_7/MP1D;PM1_8=MP1_8/MP1D;
PM1_9=MP1_9/MP1D;PM1_10=MP1_10/MP1D;
PM1_11=MP1_11/MP1D;

LMP1_2 = LOG(PM1_2);
LMP1_3 = LOG(PM1_3);LMP1_4 = LOG(PM1_4);
LMP1_5 = LOG(PM1_5);LMP1_6 = LOG(PM1_6);
LMP1_7 = LOG(PM1_7);LMP1_8 = LOG(PM1_8);
LMP1_9 = LOG(PM1_9);LMP1_10 = LOG(PM1_10);
LMP1_11 = LOG(PM1_11);

OLSQ LMP1_2, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_2H=@FIT;
OLSQ LMP1_3, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_3H=@FIT;
OLSQ LMP1_4, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_4H=@FIT;
OLSQ LMP1_5, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_5H=@FIT;
OLSQ LMP1_6, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_6H=@FIT;
OLSQ LMP1_7, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_7H=@FIT;
OLSQ LMP1_8, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_8H=@FIT;
OLSQ LMP1_9, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_9H=@FIT;
OLSQ LMP1_10, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_10H=@FIT,
OLSQ LMP1_11, C, PC1, PC2, PC3, PC4, PC5, PC6; LMP1_11H=@FIT;

OLSQ LIQ1D, C, PC1, PC2, PC3, PC4, PC5, PC6; LIQ1DH=@FIT;

FRML EQ1#50 LIQ1_2 = (TH012 + TH112*(LMP1_2H) + TH212*(LIQ1DH));
FRML EQ1#22 LIQ1_3 = (TH013 + TH113*(LMP1_3H) + TH213*(LIQ1DH));
FRML EQ1#24 LIQ1_4 = (TH014 + TH114*(LMP1_4H) + TH214*(LIQ1DH));
FRML EQ1#26 LIQ1_5 = (TH015 + TH115*(LMP1_5H) + TH215*(LIQ1DH));
FRML EQ1#28 LIQ1_6 = (TH016 + TH116*(LMP1_6H) + TH216*(LIQ1DH));
FRML EQ1#30 LIQ1_7 = (TH017 + TH117*(LMP1_7H) + TH217*(LIQ1DH));
FRML EQ1#32 LIQ1_8 = (TH018 + TH118*(LMP1_8H) + TH218*(LIQ1DH));
FRML EQ1#34 LIQ1_9 = (TH019 + TH119*(LMP1_9H) + TH219*(LIQ1DH));
FRML EQ1#36 LIQ1_10 = (TH0110 + TH1110*(LH21_10H) + TH2110*(LIQ1DH));
FRML EQ1#38 LIQ1_11 = (TH0111 + TH1111*(LMP1_11H) + TH2111*(LIQ1DH));

FRML EQ1#21 LIP1_2 = (LM012 + LM112*(LEP2_1H) + LM212*LOG(YEAR) +
LM312*LOG(PEN));
FRML EQ1#23 LIP1_3 = (LM013 + LM113*(LEP3_1H) + LM213*LOG(YEAR) +
LM313*LOG(PEN));
```

```
FRML EQ1#25 LIP1_4 = (LH014 + LH114*(LEP4_1H) + LH214*LOG(YEAR) +
LH314*LOG(PEN));
FRML EQ1#27 LIP1_5 = (LH015 + LH115*(LEP5_1H) + LH215*LOG(YEAR) +
LH315*LOG(PEN));
FRML EQ1#29 LIP1_6 = (LH016 + LH116*(LEP6_1H) + LH216*LOG(YEAR) +
LH316*LOG(PEN));
FRML EQ1#31 LIP1_7 = (LH017 + LH117*(LEP7_1H) + LH217*LOG(YEAR) +
LH317*LOG(PEN));
FRML EQ1#33 LIP1_8 = (LH018 + LH118*(LEP8_1H) + LH218*LOG(YEAR) +
LH318*LOG(PEN));
FRML EQ1#35 LIP1_9 = (LH019 + LH119*(LEP9_1H) + LH219*LOG(YEAR) +
LH319*LOG(PEN));
FRML EQ1#37 LIP1_10 = (LH0110 + LH1110*(LEP10_1H) + LH2110*LOG(YEAR) +
LH3110*LOG(PEN));
FRML EQ1#39 LIP1_11 = (LH0111 + LH1111*(LEP11_1H) + LH2111*LOG(YEAR) +
LH3111*LOG(PEN));

SELECT LIQ1_2 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#50; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
ENDDO;
SELECT LIQ1_3 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#22; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
ENDDO;
SELECT LIQ1_4 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#24; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
ENDDO;
SELECT LIQ1_5 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#26; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
ENDDO;
SELECT LIQ1_6 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#28; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
ENDDO;
SELECT LIQ1_7 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#30; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
ENDDO;
SELECT LIQ1_8 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#32; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
ENDDO;
SELECT LIQ1_9 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#34; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
ENDDO;
SELECT LIQ1_10 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#36; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
```

```
ENDDO;
SELECT LIQ1_11 > 0; IF @NOB > 6; THEN; DO;
LSQ (NOPRINT,SILENT) EQ1#38; PRINT @RSQ, @DW, @FST;
ENDDO; ELSE; DO; PRINT @NOB;
ENDDO;

SMPL 66,86;
LSQ (NOPRINT,SILENT) EQ1#21; PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ1#23; PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ1#25; PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ1#27; PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ1#29; PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ1#31; PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ1#33; PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ1#35; PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ1#37; PRINT @RSQ, @DW, @FST;
LSQ (NOPRINT,SILENT) EQ1#39; PRINT @RSQ, @DW, @FST;
END;
```

APPENDIX H
EMPIRICAL RESULTS: PRODUCT DEMAND AND CIF LINKAGE EQUATIONS STATISTICS

Table H.1 United States, Canada and South America Product Demand and CIF Price Linkage Equations Statistics

Region = United States

Product Demand Equations	@OBS	@RSQ	@DW	@FST	UTHEIL	CIF Price Linkage Equations @OBS	@RSQ	@DW	@FST	UTHEIL
CAN	13	0.17	1.42	1.04	0.380140	21	0.88	2.20	11.92	0.101784
LA	21	0.31	1.88	8.00	0.107823	21	0.77	2.13	18.20	0.078478
MED-EC	21	0.20	1.03	2.48	0.702718	21	0.93	2.38	72.38	0.048338
EC	15	0.44	2.17	5.28	0.335804	21	0.68	1.37	11.84	0.134118
ME/NA	21	0.43	1.68	5.77	0.285218	21	0.83	2.34	27.38	0.100821
FE	21	0.54	1.28	18.70	0.170387	21	0.84	1.01	87.30	0.031424
OCE	10	0.73	0.78	10.43	0.288410	21	0.38	2.47	8.22	0.334228

Region = Canada

Product Demand Equations	@OBS	@RSQ	@DW	@FST	UTHEIL	CIF Price Linkage Equations @OBS	@RSQ	@DW	@FST	UTHEIL
US	21	0.30	2.08	3.68	0.057863	21	0.81	1.82	24.53	0.088758
LA	21	0.33	1.13	4.38	0.383284	21	0.87	1.83	38.33	0.123417
MED-EC	21	0.32	1.00	4.30	0.785845	21	0.83	2.54	20.13	0.134420
EC	8	0.33	0.83	1.68	0.383800	21	0.87	2.12	37.58	0.215988
ME/NA	21	0.12	0.83	1.21	0.286231	21	0.68	2.73	34.84	0.141847
RAF	12	0.48	3.31	3.87	0.088752	21	0.88	2.18	42.52	0.123417
FE	21	0.58	1.74	8.88	0.084844	21	0.88	1.18	44.48	0.083378
OCE	31	0.52	0.87	8.68	0.228376	21	0.82	1.58	28.01	0.088368

Region = South America

Product Demand Equations	@OBS	@RSQ	@DW	@FST	UTHEIL	CIF Price Linkage Equations @OBS	@RSQ	@DW	@FST	UTHEIL
US	21	0.21	0.75	2.41	0.275334	21	0.87	2.22	37.70	0.145828
CAN	7	0.48	0.68	1.87	0.417788	21	0.68	2.11	21.88	0.120447
MED-EC	8	0.80	1.07	0.83	0.402183	21	0.78	2.83	18.38	0.181071
EC	21	0.12	1.01	1.18	0.332892	21	0.88	2.58	33.81	0.084185
ME/NA	11	0.14	1.87	0.83	0.786243	21	0.38	2.30	3.85	0.248181
COMME	8	0.31	0.28	2.60	0.478401	21	0.78	2.20	10.88	0.178538

Table H.2 Mediterranean-EEC, EEC, Rest of Western Europe Product Demand and CIF Price Linkage Equations Statistics

Region = Mediterranean-EEC

	Product Demand Equations					CIF Price Linkage Equations				
	@OBS	@RSQ	@DW	@FST	UTHEIL	@OBS	@RSQ	@DW	@FST	UTHEIL
LA	10	0.27	1.07	1.28	0.736228	21	0.78	1.04	20.03	0.103048
EC	13	0.82	2.25	27.81	0.287040	21	0.57	2.54	7.00	0.190100
RWE	12	0.70	1.10	14.55	0.554866	21	0.84	2.72	20.74	0.003577
ME/NA	10	0.10	1.60	0.73	0.451282	21	0.84	2.52	10.20	0.315045

Region = EEC

	Product Demand Equations					CIF Price Linkage Equations				
	@OBS	@RSQ	@DW	@FST	UTHEIL	@OBS	@RSQ	@DW	@FST	UTHEIL
US	21	0.30	2.03	5.12	0.270022	21	0.05	2.10	31.10	0.087405
CAN	14	0.04	1.34	0.25	0.726707	21	0.02	2.02	0.32	0.103140
LA	21	0.10	0.74	2.10	0.180170	21	0.60	1.02	32.34	0.073432
MED-EC	21	0.42	1.45	6.01	0.075005	21	0.04	1.07	104.40	0.042842
RWE	21	0.23	1.44	2.60	0.231156	21	0.74	2.20	15.07	0.090020
ME/NA	21	0.27	0.58	3.30	0.005822	21	0.04	2.10	80.80	0.043453
RAF	21	0.10	0.57	0.05	0.070182	21	0.03	2.77	74.77	0.050549
FE	21	0.15	1.00	1.61	0.020020	21	0.08	2.21	10.07	0.120060
OCE	21	0.27	2.40	3.20	0.260701	21	0.78	1.03	20.50	0.075077
COMMB	20	0.57	0.71	11.00	0.442760	21	0.88	2.34	40.30	0.056050

Region = Rest of Western Europe

	Product Demand Equations					CIF Price Linkage Equations				
	@OBS	@RSQ	@DW	@FST	UTHEIL	@OBS	@RSQ	@DW	@FST	UTHEIL
US	21	0.33	2.50	4.44	0.248258	21	0.90	1.30	32.20	0.001084
LA	21	0.13	1.20	1.30	0.145360	21	0.07	1.01	207.01	0.044011
MED-EC	21	0.20	1.24	3.41	0.080744	21	0.08	1.50	242.03	0.040080
EC	21	0.03	2.05	50.01	0.180063	21	0.01	2.01	24.70	0.060080
ME/NA	21	0.73	1.35	23.85	0.047351	21	0.60	1.00	360.02	0.020080
RAF	21	0.13	1.22	1.55	0.062720	21	0.08	2.27	225.44	0.032075
FE	17	0.01	2.32	0.10	0.740182	21	0.60	2.75	11.04	0.149770
OCE	21	0.20	0.00	3.51	0.330177	21	0.01	2.53	20.78	0.050677
COMMB	10	0.42	1.69	5.50	0.280077	21	0.04	2.71	80.05	0.080050

Table H.3 Middle East/North Africa, Rest of Africa and Far East Product Demand and CIF Price Linkage Equations Statistics

Region = Middle East/North Africa

	Product Demand Equations					CIF Price Linkage Equations				
	@OBS	@RSQ	@DW	@FST	UTHEIL	@OBS	@RSQ	@DW	@FST	UTHEIL
US	18	0.34	1.20	3.03	0.075418	21	0.21	2.44	1.53	0.788752
LA	13	0.28	2.05	2.03	0.450828	22	0.08	2.34	42.08	0.101174
MED-EC	18	0.32	1.17	3.80	0.810081	21	0.04	2.73	0.88	0.401420
EC	18	0.48	2.78	8.05	0.852080	21	0.71	2.40	13.68	0.108085
NWE	11	0.24	1.48	1.24	0.511070	21	0.02	2.38	8.05	0.508408
RAF	17	0.60	0.72	10.28	0.358933	22	0.80	2.28	52.72	0.070873
FE	21	0.27	0.02	11.83	0.385247	21	0.50	2.11	2.08	0.280771
OCE	20	0.77	1.41	27.81	0.350280	21	0.52	2.34	8.23	0.222829
COMMB	7	0.04	1.45	3.22	0.584771	21	0.71	2.05	13.07	0.254828

Region = Rest of Africa

	Product Demand Equations					CIF Price Linkage Equations				
	@OBS	@RSQ	@DW	@FST	UTHEIL	@OBS	@RSQ	@DW	@FST	UTHEIL
US	17	0.20	0.75	1.72	0.444832	21	0.07	2.02	11.26	0.193857
LA	21	0.88	1.36	17.08	0.440843	21	0.80	2.77	42.74	0.108284
MED-EC	21	0.40	1.10	0.23	0.324208	21	0.07	2.83	12.74	0.140802
EC	22	0.24	2.12	2.47	0.123770	21	0.08	1.20	248.28	0.052802
ME/NA	21	0.18	2.41	1.72	0.082017	21	0.02	2.75	32.26	0.088427
FE	13	0.08	1.25	0.56	0.287382	21	0.43	2.50	4.21	0.200404
OCE	21	0.28	1.38	12.48	0.507280	21	0.72	2.24	18.85	0.207408

Region = Far East

	Product Demand Equations					CIF Price Linkage Equations				
	@OBS	@RSQ	@DW	@FST	UTHEIL	@OBS	@RSQ	@DW	@FST	UTHEIL
US	21	0.93	2.22	124.47	0.072582	21	0.83	2.21	70.58	0.054221
CAN	8	0.40	1.02	2.07	0.725160	21	0.83	2.12	37.28	0.112127
LA	20	0.48	2.34	7.21	0.588189	21	0.78	2.11	21.80	0.172801
MED-EC	21	0.42	1.71	7.26	0.108234	21	0.84	2.01	82.22	0.041532
EC	20	0.32	1.12	4.08	0.083275	21	0.80	2.28	8.58	0.121248
NWE	13	0.34	0.82	2.58	0.284930	21	0.81	2.48	32.08	0.128008
ME/NA	21	0.40	1.82	7.74	0.145948	21	0.87	2.35	38.48	0.132410
AFR	21	0.15	0.08	1.26	0.207070	21	0.86	2.58	120.78	0.384770
OCE	21	0.10	0.78	2.07	0.226227	21	0.88	2.18	123.02	0.038042
COMMB	8	0.42	2.58	2.18	0.248580	22	0.88	2.18	42.24	0.075807

Table H.4 Oceania and Communist Bloc Product Demand and CIF Price Linkage Equations Statistics

Region = Oceania

	Product Demand Equations					CIF Price Linkage Equations				
	@OBS	@RSQ	@DW	@FST	UTHEIL	@OBS	@RSQ	@DW	@FST	UTHEIL
US	21	0.21	0.53	2.45	0.288945	21	0.88	2.17	48.21	0.080485
LA	7	0.72	2.08	5.18	0.110857	21	0.88	1.88	12.38	0.101045
MED-EC	7	0.87	0.52	4.13	0.388575	21	0.88	2.43	22.42	0.108035
ME/NA	15	0.77	1.25	10.88	0.375281	21	0.85	1.65	10.50	0.444433
FE	7	0.08	0.11	0.18	0.821817	21	0.48	2.10	4.88	0.311537

Region = Communist Bloc

	Product Demand Equations					CIF Price Linkage Equations				
	@OBS	@RSQ	@DW	@FST	UTHEIL	@OBS	@RSQ	@DW	@FST	UTHEIL
US	8	0.57	1.14	4.01	0.484848	21	0.88	2.04	54.88	0.125011
LA	20	0.44	1.88	6.78	0.221228	21	0.82	1.82	61.78	0.113208
MED-EC	21	0.11	2.10	2.11	0.108257	21	0.88	1.44	131.18	0.040714
EC	21	0.20	1.58	2.24	0.283654	21	0.82	1.78	25.32	0.108253
NEEC	15	0.45	0.32	4.50	0.820832	21	0.32	1.40	2.72	0.238686
ME/NA	21	0.55	1.85	10.87	0.116898	21	0.88	1.07	124.86	0.083128
FE	8	0.30	0.82	1.30	0.578348	21	0.82	2.83	28.96	0.088842

APPENDIX I
SENSITIVITY ANALYSIS PROGRAM

The Program #1 below was used to obtain the indices for the market demand and export supply equations in the sensitivity analysis. Program #2 was used to estimate the indices for the United States product demand equations. Since all regional sensitivity analysis programs are similar to the one presented for the United States, they will not be included here. The only differences among the regional programs are the variables and parameters used.

<u>Program #1</u>

```
FREQ NONE;
SMPL 1,20;
READ (FORMAT=LOTUS,FILE='E:\BRENES\NEWDATA.WK1');
READ (FORMAT=LOTUS,FILE='E:\BRENES\PARAM.WK1');

REPD1 = EPD1/CPI1; RMP1D = MP1D/CPI1;
REPD2 = EPD2/CPI2; RMP2D = MP2D/CPI2;
REPD3 = EPD3/CPI3; RMP3D = MP3D/CPI3;
REPD4 = EPD4/CPI4; RMP4D = MP4D/CPI4;
REPD5 = EPD5/CPI5; RMP5D = MP5D/CPI5;
REPD6 = EPD6/CPI6; RMP6D = MP6D/CPI6;
REPD7 = EPD7/CPI7; RMP7D = MP7D/CPI7;
REPD8 = EPD8/CPI8; RMP8D = MP8D/CPI8;
REPD9 = EPD9/CPI9; RMP9D = MP9D/CPI9;
REPD10 = EPD10/CPI10; RMP10D = MP10D/CPI10;
REPD11 = EPD11/CPI11; RMP11D = MP11D/CPI11;

FRML EQ1#19 EXPORT1 = EXP(DH01 + DH11*LOG(REPD1) + DH21*LOG(PRD1));
FRML EQ2#19 EXPORT2 = EXP(DHD2 + DH12*LOG(REPD2) + DH22*LOG(PRD2));
FRML EQ3#19 EXPORT3 = EXP(DHD3 + DH13*LOG(REPD3) + DH23*LOG(PRD3));
FRML EQ4#19 EXPORT4 = EXP(DH04 + DH14*LOG(REPD4) + DH24*LOG(PRD4));
FRML EQ5#19 EXPORT5 = EXP(DHD5 + DH15*LOG(REPD5) + DH25*LOG(PRD5));
FRML EQ6#19 EXPORT6 = EXP(DH06 + DH16*LOG(REPD6) + DH26*LOG(PRD6));
```

```
FRML EQ7#19 EXPORT7 - EXP(DH07 + DH17*LOG(REPO7) + DH27*LOG(PRD7));
FRML EQ8#19 EXPORT8 - EXP(DH08 + DH18*LOG(REPD8) + DH28*LOG(PRD8));
FRML EQ9#19 EXPORT9 - EXP(DH09 + DH19*LOG(REPD9) + DH29*LOG(PRD9));
FRML EQ10#19 EXPORT10 = EXP(DH010 + DH110*LOG(REPD10) +
DH210*LOG(PRD10));
FRML EQ11#19 EXPORT11 - EXP(DH011 + DH111*LOG(REPD11) +
DH211*LOG(PRD11));

FRML EQ1#20 1Q1D = EXP(RH01 + RH11*LOG(RMP1D) + RH21*LOG(GDP1/CP11)
+ RH31*LOG(POP1) + RH41*LOG(BAVAL1/CP11));
FRML EQ2#20 IQ2D - EXP(RH02 + RH12*LOG(RMP2D) + RH22*LOG(GDP2/CPI2)
+ RH32*LOG(POP2) + RH42*LOG(BAVAL2/CPI2));
FRML EQ3#20 IQ3D - EXP(RH03 + RH13*LOG(RMP3D) + RH23*LOG(GDP3/CP13)
+ RH33*LOG(POP3) + RH43*LOG(BAVAL3/CPI3));
FRML EQ4#20 1Q4D = EXP(RH04 + RH14*LOG(RHP4D) + RH24*LOG(GDP4/CP14)
+ RH34*LOG(POP4) + RH44*LOG(BAVAL4/CP14));
FRML EQ5#20 IQ5D - EXP(RH05 + RH15*LOG(RHP5D) + RH25*LOG(GDP5/CP15)
+ RH35*LOG(POP5) + RH45*LOG(BAVAL5/CPI5));
FRML EQ6#20 IQ6D - EXP(RH06 + RH16*LOG(RHP6D) + RH26*LOG(GDP6/CP16)
+ RH36*LOG(POP6) + RH46*LOG(BAVAL6/GP16));
FRML EQ7#20 1Q7D = EXP(RH07 + RH17*LOG(RMP7D) + RH27*LOG(GDP7/CP17)
+ RH37*LOG(POP7) + RH47*LOG(BAVAL7/GP17));
FRML EQ8#20 IQ8D - EXP(RH08 + RH18*LOG(RMP8D) + RH28*LOG(GDP8/CPI8)
+ RH38*LOG(POP8) + RH48*LOG(BAVAL8/GP18));
FRML EQ9#20 1Q9D = EXP(RH09 + RH19*LOG(RMP9D) + RH29*LOG(GDP9/CP19)
+ RH39*LOG(POP9) + RH49*LOG(BAVAL9/CP19));
FRML    EQ10#20    IQ10D    =    EXP(RH010    +    RH110*LOG(RMP10D)    +
RH210*LOG(GDP10/GP110) + RH310*LOG(POP10) + RH410*LOG(BAVAL10/CPI10));
FRML    EQ11#20    IQ11D    -    EXP(RH011    +    RM111*LOG(RMP11D)    +
RH211*LOG(GDP11/GP111) + RH311*LOG(POP11) + RH411*LOG(BAVAL11/CP111));

XRMP1D-RHP1D;      XPOP1-POP1;      XGDP1-GDP1;
XRMP2D-RMP2D;      XPOP2-POP2;      XGDP2-GDP2;
XRMP3D-RMP3D;      XPOP3-POP3;      XGDP3-GDP3;
XRMP4D-RMP4D;      XPOP4-POP4;      XGDP4-GDP4;
XRMP5D-RHP5D;      XPOP5-POP5;      XGDP5-GDP5;
XRMP6D-RHP6D;      XPOP6-POP6;      XGDP6-GDP6;
XRMP7D-RHP7D;      XPOP7-POP7;      XGDP7-GDP7;
XRMP8D-RHP8D;      XPOP8-POP8;      XGDP8-GDP8;
XRMP9D-RHP9D;      XPOP9-POP9;      XGDP9-GDP9;
XRMP10D-RHP10D;    XPOP10-POP10;    XGDP10-GDP10;
XRMP11D-RMP11D;    XPOP11-POP11;    XGDP11-GDP11;

XREPD1-REPD1;      XPRD1-PRD1;
XREPD2-REPD2;      XPRD2-PRD2;
XREPD3-REPD3;      XPRD3-PRD3;
XREPD4-REPD4;      XPRD4-PRD4;
XREPD5-REPD5;      XPRD5-PRD5;
XREPD6-REPD6;      XPRD6-PRD6;
XREPD7-REPD7;      XPRD7-PRD7;
XREPD8-REPD8;      XPRD8-PRD8;
XREPD9-REPD9;      XPRD9-PRD9;
```

```
XREPD1D-REPD1D;     XPRD10-PRD1D;
XREPD11-REPD11;     XPRD11-PRD11;

? SIMULATION #1 - TOTAL MARKET DEMAND VARYING AVERAGE MARKET;
SMPL 1,1;
I-.5;
SMPL 2,2D; I-I(-1)+.1;
SMPL 1,2D;
1D-1;
RMP1D-XRMP1D*I;RMP2D-XRMP2D*1;RMP3D-XRMP3D*1;RMP4D-XRMP4D*1;
RMP5D-XRMP5D*1;RMP6D-XRMP6D*1;RMP7D-XRMP7D*1;RMP8D-XRMP8D*I;
RMP9D-XRMP9D*1;RMP1DD-XRMP1DD*I;RMP11D-XRMP11D*I;

GENR EQ1#2D;GENR EQ2#2D;GENR EQ3#2D;GENR EQ4#2D;GENR EQ5#2D;
GENR EQ6#2D;GENR EQ7#2D;GENR EQ8#20;GENR EQ9#2D;GENR EQ10#2D;
GENR EQ11#2D;

WRITE (FORMAT-LOTUS,FILE-'C:\LOTUS\SIM#1.WK1')
1D 1 RMP1D RMP2D RMP3D RMP4D RMP5D RMP6D RMP7D RMP8D RMP9D
RMP10D RMP11D
1Q1D IQ2D IQ3D IQ4D IQ5D 1Q6D 1Q7D 1Q8D 1Q9D 1Q1DD 1Q11D
EXPORT1 EXPORT2 EXPORT3 EXPORT4 EXPORT5 EXPORT6 EXPORT6
EXPORT7 EXPORT8 EXPORT9 EXPORT1D EXPDRT11;

RMP1D-XRMP1D;RMP2D-XRMP2D;RMP3D-XRMP3D;RMP4D-XRMP4D;RMP5D-XRMP5D;
RMP6D-XRMP6D;RMP7D-XRMP7D;RMP8D-XRMP8D;RMP9D-XRMP9D;RMP1DD-XRMP10D;
RMP11D-XRMP11D;

? SIMULATION #2 - TOTAL MARKET DEMAND VARYING INCOME (GDP);
SMPL 1,1;
1- 5;
SMPL 2,2D; 1-1(-1)+.1;
SMPL 1,2D;
1D-1;

GDP1-XGDP1*1;GDP2-XGDP2*1;GDP3-XGDP3*1;GDP4-XGDP4*I;GDP5-XGDP5*I;
GDP6-XGDP6*1;GDP7-XGDP7*I;GDP8-XGDP8*1;GDP9-XGDP9*I;GDP1D-XGDP1D*1;
GDP11-XGDP11*I;

GENR EQ1#2D;GENR EQ2#2D;GENR EQ3#2D;GENR EQ4#2D;GENR EQ5#2D;
GENR EQ6#2D;GENR EQ7#2D;GENR EQ8#2D;GENR EQ9#20;GENR EQ1D#2D;
GENR EQ11#2D;

WRITE (FORMAT-LOTUS,FILE-'G:\LOTUS\S1M#2.WK1')
ID 1 GDP1 GDP2 GDP3 GDP4 GDP5 GDP6 GDP7 GDP8 GDP9
GDP1D GDP11
1Q1D 1Q2D 1Q3D 1Q4D 1Q5D 1Q6D 1Q7D 1Q8D 1Q9D 1Q1DD 1Q11D;

GDP1-XGDP1;GDP2-XGDP2;GDP3-XGDP3;GDP4-XGDP4;GDP5-XGDP5;GDP6-XGDP6;
GDP7-XGDP7;GDP8-XGDP8;GDP9-XGDP9;GDP1D-XGDP10;GDP11-XGDP11;
```

```
? SIMULATION #3 - EXPORT SUPPLY VARYING FOB EXPORT PRICE;
SMPL 1,1;
I=.5;
SMPL 2,20; I=I(-1)+.1;
SMPL 1,20;
ID=1;
REPD1=XREPD1*I;REPD2=XREPD2*I;REPD3=XREPD3*I;REPD4=XREPD4*I;
REPD5=XREPD5*I;REPD6=XREPD6*I;REPD7=XREPD7*I;REPD8=XREPD8*I;
REPD9=XREPD9*I;REPD10=XREPD10*I;REPD11=XREPD11*I;

GENR EQ1#19;GENR EQ2#19;GENR EQ3#19;GENR EQ4#19;GENR EQ5#19;
GENR EQ6#19;GENR EQ7#19;GENR EQ8#19;GENR EQ9#19;GENR EQ10#19;
GENR EQ11#19;

WRITE (FORMAT=LOTUS,FILE='C:\LOTUS\SIM#3.WK1')
ID I REPD1 REPD2 REPD3 REPD4 REPD5 REPD6 REPD7 REPD8 REPD9
REPD10 REPD11
EXPORT1 EXPORT2 EXPORT3 EXPORT4 EXPORT5 EXPORT6
EXPORT7 EXPORT8 EXPORT9 EXPORT10 EXPORT11;

REPD1=XREPD1;REPD2=XREPD2;REPD3=XREPD3;REPD4=XREPD4;REPD5=XREPD5;
REPD6=XREPD6;REPD7=XREPD7;REPD8=XREPD8;REPD9=XREPD9;REPD10=XREPD10;
REPD11=XREPD11;

? SIMULATION #4 - EXPORT SUPPLY VARYING FRESH PRODUCTION;
SMPL 1,1;
I=.5;
SMPL 2,20; I=I(-1)+.1;
SMPL 1,20;
ID=1;

PRD1=XPRD1*I;PRD2=XPRD2*I;PRD3=XPRD3*I;PRD4=XPRD4*I;PRD5=XPRD5*I;
PRD6=XPRD6*I;PRD7=XPRD7*I;PRD8=XPRD8*I;PRD9=XPRD9*I;PRD10=XPRD10*I;
PRD11=XPRD11*I;

GENR EQ1#19;GENR EQ2#19;GENR EQ3#19;GENR EQ4#19;GENR EQ5#19;
GENR EQ6#19;GENR EQ7#19;GENR EQ8#19;GENR EQ9#19;GENR EQ10#19;
GENR EQ11#19;

WRITE (FORMAT=LOTUS,FILE='C:\LOTUS\SIM#4.WK1')
ID I PRD1 PRD2 PRD3 PRD4 PRD5 PRD6 PRD7 PRD8 PRD9
PRD10 PRD11
EXPORT1 EXPORT2 EXPORT3 EXPORT4 EXPORT5 EXPORT6
EXPORT7 EXPORT8 EXPORT9 EXPORT10 EXPORT11;

PRD1=XPRD1;PRD2=XPRD2;PRD3=XPRD3;PRD4=XPRD4;PRD5=XPRD5;
PRD6=XPRD6;PRD7=XPRD7;PRD8=XPRD8;PRD9=XPRD9;PRD10=XPRD10;
PRD11=XPRD11;
END;
```

Program #2

```
REGION #1
FREQ NONE;
SMPL 1,7;
READ (FORMAT=LOTUS,FILE='C:\LOTUS\NEWDATA.WK1');
READ (FORMAT=LOTUS,FILE='C:\LOTUS\PARAM.WK1');

PM1_2=MP1_2/MP1D;
PM1_3=MP1_3/MP1D;PM1_4=MP1_4/MP10;
PM1_5=MP1_5/MP1D;PM1_6=MP1_6/MP10;
PM1_7=MP1_7/MP1D;PM1_8=MP1_8/MP1D;
PM1_9=MP1_9/MP1D;PM1_10=MP1_10/MP1D;
PM1_11=MP1_11/MP1D;

FRML EQ1#50 IQ1_2 = EXP(TH012 + TH112*LOG(PM1_2) + TH212*LOG(IQ1D));
FRML EQ1#22 IQ1_3 = EXP(TH013 + TH113*LOG(PM1_3) + TH213*LOG(IQ1D));
FRML EQ1#24 IQ1_4 = EXP(TH014 + TH114*LOG(PM1_4) + TH214*LOG(IQ1D));
FRML EQ1#26 IQ1_5 = EXP(TH015 + TH115*LOG(PM1_5) + TH215*LOG(IQ1D));
FRML EQ1#28 IQ1_6 = EXP(TH016 + TH116*LOG(PM1_6) + TH216*LOG(IQ1D));
FRML EQ1#30 IQ1_7 = EXP(TH017 + TH117*LOG(PM1_7) + TH217*LOG(IQ1D));
FRML EQ1#32 IQ1_8 = EXP(TH018 + TH118*LOG(PM1_8) + TH218*LOG(IQ1D));
FRML EQ1#34 IQ1_9 = EXP(TH019 + TH119*LOG(PM1_9) + TH219*LOG(IQ1D));
FRML EQ1#36 IQ1_10 = EXP(TH0110 + TH1110*LOG(PM1_10) +
TH2110*LOG(IQ1D));
FRML EQ1#38 IQ1_11 = EXP(TH0111 + TH1111*LOG(PM1_11) +
TH2111*LOG(IQ1D));

FRML EQ1#21 IP1_2 = EXP(LH012 + LH112*LOG(EP2_1) + LH212*LOG(YEAR) +
LH312*LOG(PEN));
FRML EQ1#23 IP1_3 = EXP(LH013 + LH113*LOG(EP3_1) + LH213*LOG(YEAR) +
LH313*LOG(PEN));
FRML EQ1#25 IP1_4 = EXP(LH014 + LH114*LOG(EP4_1) + LH214*LOG(YEAR) +
LH314*LOG(PEN));
FRML EQ1#27 IP1_5 = EXP(LH015 + LH115*LOG(EP5_1) + LH215*LOG(YEAR) +
LH315*LOG(PEN));
FRML EQ1#29 IP1_6 = EXP(LH016 + LH116*LOG(EP6_1) + LH216*LOG(YEAR) +
LH316*LOG(PEN));
FRML EQ1#31 IP1_7 = EXP(LH017 + LH117*LOG(EP7_1) + LH217*LOG(YEAR) +
LH317*LOG(PEN));
FRML EQ1#33 IP1_8 = EXP(LH018 + LH118*LOG(EP8_1) + LH218*LOG(YEAR) +
LH318*LOG(PEN));
FRML EQ1#35 IP1_9 = EXP(LH019 + LH119*LOG(EP9_1) + LH219*LOG(YEAR) +
LH319*LOG(PEN));
FRML EQ1#37 IP1_10 = EXP(LH0110 + LH1110*LOG(EP10_1) +
LH2110*LOG(YEAR)+LH3110*LOG(PEN));
FRML EQ1#39 IP1_11 = EXP(LH0111 + LH1111*LOG(EP11_1) +
LH2111*LOG(YEAR)+LH3111*LOG(PEN));

XPM1_2=PM1_2;      XEP2_1=EP2_1;
XPM1_3=PM1_3;      XEP3_1=EP3_1;
XPM1_4=PM1_4;      XEP4_1=EP4_1;
```

```
XPM1_5=PM1_5;       XEP5_1=EP5_1;
XPM1_6=PM1_6;       XEP6_1=EP6_1;
XPM1_7=PM1_7;       XEP7_1=EP7_1;
XPM1_8=PM1_8;       XEP8_1=EP8_1;
XPM1_9=PM1_9;       XEP9_1=EP9_1;
XPM1_10=PM1_10;     XEP10_1=EP10_1;
XPM1_11=PM1_11;     XEP11_1=EP11_1;
X1Q1D=IQ1D;

? SIMULATION #1 - PRODUCT DEMAND VARYING RELATIVE PRICES;
SMPL 1,1;
I=.5;
SMPL 2,7;
I=I(-1)+.1;
SMPL 1,7;

PM1_2=XPM1_2*I;PM1_3=XPM1_3*I;PM1_4=XPM1_4*I;PM1_5=XPM1_5*I;
PM1_6=XPM1_6*I;PM1_7=XPM1_7*I;PM1_8=XPM1_8*I;PM1_9=XPM1_9*I;
PM1_10=XPM1_10*I;PM1_11=XPM1_11*I;

EP2_1=XEP2_1*I;EP3_1=XEP3_1*I;EP4_1=XEP4_1*I;EP5_1=XEP5_1*I;
EP6_1=XEP6_1*I;EP7_1=XEP7_1*I;EP8_1=XEP8_1*I;EP9_1=XEP9_1*I;
EP10_1=XEP10_1*I;EP11_1=XEP11_1*I;

GENR EQ1#50;GENR EQ1#22;GENR EQ1#24;GENR EQ1#26;GENR EQ1#28;
GENR EQ1#30;GENR EQ1#32;GENR EQ1#34;GENR EQ1#36;GENR EQ1#38;

GENR EQ1#21;GENR EQ1#23;GENR EQ1#25;GENR EQ1#27;GENR EQ1#29;
GENR EQ1#31;GENR EQ1#33;GENR EQ1#35;GENR EQ1#37;GENR EQ1#39;

WRITE (FORMAT=LOTUS,FILE='G:\LOTUS\SIM1#1.WK1')
I PM1_2 PM1_3 PM1_4 PM1_5 PM1_6 PM1_7 PM1_8 PM1_9
PM1_10 PM1_11
IQ1_2 IQ1_3 IQ1_4 IQ1_5 IQ1_6 IQ1_7 IQ1_8 IQ1_9
IQ1_10 IQ1_11

PM1_2=XPM1_2;PM1_3=XPM1_3;PM1_4=XPM1_4;PM1_5=XPM1_5;
PM1_6=XPM1_6;PM1_7=XPM1_7;PM1_8=XPM1_8;PM1_9=XPM1_9;
PM1_10=XPM1_10;PM1_11=XPM1_11;

EP2_1=XEP2_1;EP3_1=XEP3_1;EP4_1=XEP4_1;EP5_1=XEP5_1;
EP6_1=XEP6_1;EP7_1=XEP7_1;EP8_1=XEP8_1;EP9_1=XEP9_1;
EP10_1=XEP10_1;EP11_1=XEP11_1;

? SIMULATION #2 - PRODUCT DEMAND VARYING TOTAL MARKET DEMAND OR MARKET
SIZE;

SMPL 1,1;
I=.5;
SMPL 2,7;
I=I(-1)+.1;
```

```
SMPL 1,7;
IQ1D-X1Q1D*1;

GENR EQ1#50;GENR EQ1#22;GENR EQ1#24;GENR EQ1#26;
GENR EQ1#30;GENR EQ1#34;GENR EQ1#36;

GENR EQ1#21;GENR EQ1#23;GENR EQ1#25;GENR EQ1#27;
GENR EQ1#31;GENR EQ1#35;GENR EQ1#37;

WRITE (FORMAT-LOTUS,FILE-'C:\LOTUS\S1M1#2.WK1')
I 1Q1D
1Q1_2 1Q1_3 IQ1_4 IQ1_5 IQ1_6 IQ1_7 IQ1_8 1Q1_9
1Q1_10 1Q1_11
END;
```

APPENDIX J
INDICES OBTAINED FROM THE SENSITIVITY ANALYSIS

The following tables present the indices produced by the sensitivity analysis developed in this study. Each table is related to one or two of the figures included in the main text. The indices provide additions that could be used to evaluate with more precision the changes in the relevant dependent variables given changes in the variables selected.

Figure 6.1 and 6.2

OBS	Average Market Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	2.10	1.23	1.02	1.32	1.52	1.44	1.50	1.08	0.94	1.00	1.14
2	0.8	1.81	1.14	1.01	1.18	1.10	1.28	1.28	1.06	0.88	1.41	1.11
3	0.9	1.26	1.08	1.01	1.08	1.13	1.11	1.13	1.03	0.98	1.18	1.14
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	0.91	0.91	0.98	0.93	0.98	0.91	0.90	0.96	1.02	0.91	0.88
6	1.2	0.87	0.90	0.98	0.87	0.81	0.81	0.81	0.95	1.01	0.74	0.80
7	1.3	0.10	0.86	0.98	0.81	0.73	0.70	0.74	0.94	1.01	0.81	0.71

Figure 6.3 and 6.4

OBS	Income Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	1.22	0.70	0.97	1.26	0.70	1.00	0.86	1.03	0.85	1.13	0.86
2	0.8	1.11	0.86	0.86	1.11	0.88	1.00	0.91	1.02	0.97	1.00	0.77
3	0.9	1.08	0.93	0.98	1.07	0.93	1.00	0.96	1.01	0.98	1.04	0.88
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	0.91	1.07	1.01	0.94	1.07	1.00	1.04	0.98	1.01	0.97	1.12
6	1.2	0.86	1.13	1.02	0.88	1.11	1.00	1.08	0.98	1.03	0.94	1.24
7	1.3	0.87	1.20	1.02	0.81	1.10	1.00	1.11	0.98	1.04	0.92	1.15

Figure 6.5

OBS	FOB Average Export Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	1.82	0.41	1.80	1.00	1.10	2.17	0.86	1.07	1.50	2.24	1.86
2	0.8	1.41	0.81	1.04	1.00	1.00	1.81	0.71	1.04	1.12	1.88	1.40
3	0.9	1.18	0.78	1.02	1.00	1.03	1.32	0.80	1.02	1.14	1.27	1.21
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	0.81	1.24	0.98	1.00	0.97	0.78	1.11	0.96	0.88	0.81	0.84
6	1.2	0.74	1.11	0.97	1.00	0.95	0.82	1.30	0.97	0.80	0.68	0.72
7	1.3	0.64	1.50	0.86	1.00	0.91	0.10	1.45	0.95	0.72	0.11	0.62

Figure 8.6

OBS	FOB Average Export Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	0.75	0.70	0.80	0.70	0.70	0.70	0.05	0.68	0.95	0.00	0.47
2	0.8	0.92	0.80	0.87	0.87	0.68	0.80	0.77	0.92	0.87	0.85	0.62
3	0.9	0.01	0.60	0.03	0.83	0.83	0.60	0.80	0.80	0.08	0.07	0.60
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	1.00	1.10	1.00	1.00	1.07	1.13	1.15	1.03	1.01	1.05	1.53
6	1.2	1.10	1.20	1.12	1.15	1.13	1.50	1.24	1.07	1.03	1.00	1.40
7	1.3	1.27	1.30	1.10	1.16	1.20	1.30	1.57	1.10	1.04	1.00	1.70

Figure 8.7

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7		0.80	0.80	1.50	1.54	1.00	7.50	1.00	0.07	1.71	1.00
2	0.8		0.75	0.78	1.51	1.51	1.00	3.40	1.00	0.10	1.40	1.00
3	0.9		0.86	0.80	1.09	1.14	1.00	1.80	1.00	0.45	1.17	1.00
4	1.0		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1		1.15	1.11	0.92	0.80	1.00	0.50	1.00	2.05	0.87	1.00
6	1.2		1.50	1.21	0.86	0.80	1.00	0.50	1.00	5.05	0.70	1.00
7	1.3		1.40	1.55	0.80	0.73	1.00	0.53	1.00	7.17	0.87	1.00

Figure 8.8

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7		0.10	0.31	0.00	0.75	1.00	0.05	1.00	0.01	0.00	1.00
2	0.8		3.12	0.40	0.00	0.83	1.00	0.07	1.00	0.06	0.00	1.00
3	0.9		1.71	0.71	0.00	0.92	1.00	0.50	1.00	0.04	0.04	1.00
4	1.0		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1		0.62	1.57	13.56	1.00	1.00	5.05	1.00	1.06	17.55	1.00
6	1.2		0.30	1.85	140.45	1.10	1.00	0.45	1.00	1.11	550.00	1.00
7	1.3		0.26	5.30	1307.57	1.54	1.00	21.40	1.00	1.10	5001.57	1.00

Figure 8.9

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	1.22		1.10	0.33	1.75	1.00	1.07	0.80	1.30	2.40	1.00
2	0.8	1.15		1.11	0.50	1.45	1.00	1.04	0.85	1.25	1.70	1.00
3	0.9	1.04		1.05	0.72	1.10	1.00	1.02	0.80	1.10	1.51	1.00
4	1.0	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	0.85		0.80	1.34	0.80	1.00	0.80	1.04	0.92	0.70	1.00
6	1.2	0.80		0.92	1.70	0.75	1.00	0.87	1.07	0.84	0.85	1.00
7	1.3	0.80		0.68	2.25	0.60	1.00	0.85	1.10	0.70	0.51	1.00

Figure 8.10

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	0.01		752.01	4751.03	0.01	1.00	5.03	5.00	0.32	0.01	1.00
2	0.8	0.74		85.05	100.00	0.05	1.00	2.75	3.07	0.40	0.04	1.00
3	0.9	0.87		7.00	12.17	0.25	1.00	1.31	1.70	0.71	0.22	1.00
4	1.0	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	1.14		0.17	0.10	3.54	1.00	0.05	0.05	1.55	3.00	1.00
6	1.2	1.20		0.03	0.01	11.22	1.00	0.44	0.40	1.70	14.10	1.00
7	1.3	1.43		0.01	0.00	32.42	1.00	0.30	0.27	2.51	45.05	1.00

Figure 0.11

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	2.16	0.50		2.07	1.04	1.00	2.66	1.00	1.00	1.00	0.11
2	0.8	1.62	0.81		1.18	1.02	1.00	1.84	1.00	1.00	1.00	0.80
1	0.9	1.20	0.82		1.24	1.01	1.00	1.37	1.00	1.00	1.00	0.84
4	1.0	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	0.81	1.20		0.82	0.90	1.00	0.71	1.00	1.00	1.00	1.17
6	1.2	0.07	1.42		0.86	0.90	1.00	0.58	1.00	1.00	1.00	1.10
7	1.3	0.17	1.86		0.10	0.87	1.00	0.40	1.00	1.00	1.00	1.11

Figure 0.12

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	0.00	1.46		0.15	0.58	1.00	2.71	1.00	1.00	1.00	0.01
2	0.8	0.07	1.27		0.12	0.72	1.00	1.86	1.00	1.00	1.00	0.01
1	0.9	0.84	1.12		0.38	0.81	1.00	1.34	1.00	1.00	1.00	0.24
4	1.0	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	1.08	0.86		1.01	1.11	1.00	0.77	1.00	1.00	1.00	1.88
6	1.2	1.12	0.82		2.13	1.31	1.00	0.60	1.00	1.00	1.00	11.06
7	1.3	1.10	0.70		3.61	1.40	1.00	0.40	1.00	1.00	1.00	31.17

Figure 0.13

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	1.00	1.00	0.13		1.10	1.32	1.12	1.00	1.00	1.00	1.00
2	0.8	1.00	1.00	0.67		2.07	1.10	1.21	1.00	1.00	1.00	1.00
3	0.9	1.00	1.00	0.83		1.84	1.00	1.10	1.00	1.00	1.00	1.00
4	1.0	1.00	1.00	1.00		1.00	1.06	1.00	1.00	1.00	1.00	1.00
1	1.1	1.00	1.00	1.10		0.84	0.83	0.82	1.00	1.00	1.00	1.00
6	1.2	1.00	1.00	1.10		0.42	0.87	0.81	1.00	1.001.	1.00	1.00
7	1.3	1.00	1.00	1.10		0.20	0.82	0.80	1.00	00	1.00	1.00

Figure 0.14

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	1.00	1.00	6.01		0.02	0.01	0.43	1.00	1.00	1.00	1.00
2	0.8	1.00	1.00	0.10		0.00	0.06	0.10	1.00	1.00	1.00	1.00
1	0.9	1.00	1.00	0.42		0.31	0.26	0.70	1.00	1.00	1.00	1.00
4	1.0	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	1.00	1.00	2.10		2.90	3.30	1.21	1.00	1.00	1.00	1.00
6	1.2	1.00	1.00	4.47		7.01	10.13	1.14	1.00	1.00	1.00	1.00
7	1.3	1.00	1.00	6.64		18.82	28.76	1.66	1.00	1.00	1.00	1.00

Figure 0.15

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	5.73	1.70	0.83	0.70		2.24	0.51	1.26	0.23	0.10	20.22
2	0.8	2.86	1.41	0.86	0.81		1.86	0.80	1.17	0.40	0.32	7.72
1	0.9	1.05	1.10	0.90	0.92		1.27	0.82	1.08	0.65	0.58	2.62
4	1.0	1.00	1.00	1.06	1.00		1.00	1.00	1.00	1.00	1.00	1.00
1	1.1	0.83	0.00	1.02	1.07		0.91	1.16	0.93	1.49	1.62	0.42
6	1.2	0.41	0.74	1.04	1.11		0.90	1.41	0.86	2.11	2.53	0.10
7	1.3	0.20	0.01	1.01	1.22		0.55	1.03	0.63	2.04	1.80	0.00

Figure 6.16

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	HE/NA	RAF	FE	OCE	COMMB
1	0.7	4.07	5.00	0.30	0.52		0.00	0.05	1.02	0.00	0.07	0.01
2	0.8	2.41	7.50	0.50	0.80		5.87	0.07	1.01	0.01	0.00	0.00
3	0.9	1.51	1.50	0.70	0.82		1.65	0.90	1.00	0.00	0.37	0.70
4	1.0	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
5	1.1	0.80	0.80	1.70	1.10		0.57	1.01	1.00	0.77	7.77	3.47
6	1.7	0.40	0.50	1.01	1.40		0.35	1.03	0.80	70.75	7.00	10.40
7	1.3	0.50	0.34	1.00	1.62		0.22	1.04	0.00	450.02	16.44	20.42

Figure 6.17

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	HE/NA	RAF	FE	OCE	COMMB
1	0.7	23.71	1.00	1.24	2.82	2.58		2.58	0.80	1.31	4.53	0.15
2	0.8	7.25	1.00	1.10	1.63	1.01		1.01	0.87	1.10	0.87	0.50
3	0.9	7.55	1.00	1.07	1.33	1.37		1.37	0.84	1.00	0.85	0.57
4	1.0	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
5	1.1	0.45	1.00	0.84	0.77	0.78		0.78	1.08	0.85	1.10	1.07
6	1.7	0.20	1.00	0.80	0.81	0.82		0.82	1.12	0.87	1.30	7.07
7	1.3	0.10	1.00	0.84	0.40	0.50		0.50	1.18	0.82	1.00	4.11

Figure 6.18

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	HE/NA	RAF	FE	OCE	COMMB
1	0.7	47.94	1.00	0.05	0.56	0.36		0.83	0.74	4.39	0.07	1.02
2	0.8	11.26	1.00	0.77	0.70	0.55		0.85	0.84	2.32	0.10	1.45
3	0.9	5.14	1.00	0.88	0.84	0.70		0.98	0.82	1.55	0.40	1.10
4	1.0	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00
5	1.1	0.30	1.00	1.12	1.17	1.20		1.02	1.08	0.87	2.04	0.85
6	1.7	0.14	1.00	1.74	1.34	1.82		1.04	1.15	0.47	5.80	0.74
7	1.3	0.06	1.00	1.37	1.53	2.01		1.06	1.73	0.54	7.07	0.84

Figure 6.19

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	2.77	1.00	0.52	0.93	2.74	1.50		1.47	1.27	1.80	3.74
2	0.8	1.87	1.00	0.87	0.90	1.80	1.21		1.27	1.18	1.50	7.78
3	0.9	1.77	1.00	0.93	0.98	1.35	1.08		1.12	1.07	1.17	1.40
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
5	1.1	0.90	1.00	1.10	1.07	0.70	0.87		0.90	0.84	0.87	0.70
6	1.2	0.55	1.00	1.30	1.04	0.60	0.88		0.82	0.80	0.77	0.51
7	1.3	0.22	1.00	1.01	1.05	0.40	0.00		0.76	0.64	0.90	0.50

Figure 6.20

OBS	Total Maket Demand Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	0.50	1.00	0.00	0.77	0.40	0.28		0.14	0.31	0.18	0.05
7	0.8	0.71	1.00	0.22	0.44	0.50	0.45		0.20	0.40	0.55	0.10
5	0.8	0.85	1.00	0.40	0.00	0.78	0.00		0.55	0.71	0.01	0.42
4	1.6	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00
5	1.1	1.10	1.00	1.00	1.47	1.78	1.41		1.71	1.37	1.57	7.20
6	1.2	1.33	1.00	3.42	1.65	1.60	1.03		2.70	1.07	2.57	4.51
7	1.5	1.50	1.00	5.07	2.01	1.07	2.57		4.35	2.37	3.47	0.74

Figure 6 11

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	NWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	1.01	1.00	1.10	1.14	0.04	1.00	0.10		2.44	1.00	1.00
1	0.8	1.50	1.00	2.27	1.00	0.00	1.00	0.00		1.11	3.10	1.00
3	0.9	1.21	1.00	1.41	1.04	0.09	1.00	0.93		1.30	1.03	1.00
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
1	1.1	0.84	1.00	0.10	0.01	1.02	1.00	1.06		0.70	0.10	1.00
6	1.2	0.12	1.00	0.11	0.04	1.03	1.00	1.13		0.03	0.31	1.00
1	1.1	0.62	1.00	0.30	0.01	1.94	1.00	1.19		0.11	0.22	1.00

Figure 6 11

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.1	1.34	1.00	0.04	0.08	0.00	1.00	0.01		11.01	1.53	1.00
1	0.8	1.20	1.00	0.00	0.11	0.16	1.00	0.01		4.11	1.10	1.00
3	0.9	1.41	1.00	0.00	0.48	0.88	1.00	0.97		2.00	1.11	1.00
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
1	1.1	0.11	1.00	1.02	1.04	1.11	1.00	1.02		0.13	0.00	1.00
6	1.2	0.32	1.00	1.01	1.14	1.22	1.00	1.01		0.26	0.01	1.00
1	1.1	0.10	1.00	1.01	0.11	1.33	1.00	1.07		0.10	0.11	1.00

Figure 6 21

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.7	0.82	2.05	3.51	0.86	2.00	0.10	1.32	1.74		1.01	1.10
1	0.8	0.00	1.03	1.10	0.01	1.00	0.11	1.10	1.00		1.01	1.12
3	0.9	0.94	1.30	1.41	0.95	1.37	0.88	1.08	1.31		1.01	1.01
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00
1	1.1	1.08	0.16	0.12	1.04	0.71	1.11	0.93	0.70		0.69	0.01
6	1.1	1.11	0.59	0.11	1.00	0.50	1.31	0.01	0.00		0.60	0.01
1	1.3	1.10	0.48	0.40	1.12	0.41	1.47	0.01	0.40		0.01	0.00

Figure 6 24

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.1	0.30	0.21	0.31	0.40	0.23	1.14	1.01	0.10		0.01	0.11
2	0.8	0.11	0.44	0.40	0.94	0.40	1.10	1.01	0.55		0.70	0.11
1	0.9	0.10	0.00	0.11	0.01	0.01	1.32	1.00	0.15		0.80	0.52
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00
1	1.1	1.20	1.42	1.31	1.21	1.40	0.70	1.00	1.29		1.11	1.01
6	1.1	1.01	1.01	1.10	1.44	1.11	0.01	1.00	1.83		1.23	3.14
1	1.1	2.01	2.51	2.28	1.70	1.01	0.10	0.09	1.01		1.14	1.10

Figure 6 25

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMMB
1	0.1	1.11	1.00	0.24	0.10	1.00	1.00	10.48	1.00	1.01		1.00
1	0.8	1.11	1.00	0.41	0.11	1.00	1.00	4.35	1.00	1.37		1.00
3	0.9	1.14	1.00	0.00	0.56	1.00	1.00	2.00	1.00	1.10		1.00
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00
5	1.1	0.80	1.00	1.46	1.83	1.00	1.00	0.13	1.00	0.81		1.00
6	1.2	0.80	1.00	1.01	1.11	1.00	1.00	0.30	1.00	0.77		1.00
1	1.3	0.11	1.00	2.04	1.80	1.00	1.00	0.10	1.00	0.60		1.00

Figure 6.26

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMME
1	0.7	0.20	1.00	4.10	0.12	1.00	1.00	240.72	1.00	0.47		1.00
2	0.8	0.11	1.00	2.11	0.20	1.00	1.00	31.62	1.00	0.53		1.00
3	0.9	0.70	1.00	1.14	0.11	1.00	1.00	1.11	1.00	0.80		1.00
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00
5	1.1	1.20	1.00	0.87	1.77	1.00	1.00	0.23	1.00	1.22		1.00
6	1.2	1.62	1.00	0.47	2.97	1.00	1.00	0.09	1.00	1.47		1.00
7	1.3	2.01	1.00	0.14	4.70	1.00	1.00	0.03	1.00	1.74		1.00

Figure 6.27

OBS	Import Price Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMME
1	0.7	20.01	1.00	1.10	0.01	2.10	1.13	1.74	1.00	0.01	1.00	
2	0.8	0.30	1.00	2.14	0.07	1.83	1.00	1.41	1.00	0.10	1.00	
3	0.9	2.71	1.00	1.43	0.90	1.20	1.04	1.10	1.00	0.42	1.00	
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	1.1	0.40	1.00	0.72	1.01	0.61	0.97	0.80	1.00	2.10	1.00	
6	1.2	0.10	1.00	0.14	1.03	0.87	0.84	0.71	1.00	4.44	1.00	
7	1.3	0.08	1.06	0.41	1.04	0.56	0.92	0.67	1.00	6.53	1.00	

Figure 6.28

OBS	Total Market Demand Index	US	CAN	LA	MED-EC	EC	RWE	ME/NA	RAF	FE	OCE	COMME
1	0.7	0.84	1.00	0.30	0.01	0.72	0.23	0.04	1.00	0.00	1.00	
2	0.8	0.80	1.00	0.47	0.04	0.01	0.40	0.70	1.00	0.17	1.00	
3	0.9	0.95	1.00	0.70	0.07	0.91	0.05	0.44	1.00	0.44	1.00	
4	1.0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	1.1	1.05	1.00	1.34	1.03	1.00	1.40	1.13	1.00	2.11	1.00	
6	1.2	1.00	1.00	1.01	1.01	1.10	2.13	1.21	1.00	4.10	1.00	
7	1.3	1.24	1.00	2.42	1.09	1.27	2.00	1.10	1.00	7.04	1.00	

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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